Middlesex County Retirement System

Actuarial Valuation and Review

as of January 1, 2020

Segal

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July 27, 2020

Middlesex County Retirement Board
Middlesex County Retirement System
25 Linnell Circle
Billerica, MA 01865

Dear Board Members:

We are pleased to submit this Actuarial Valuation and Review as of January 1, 2020. It summarizes the actuarial data used in the valuation, analyzes the preceding two years' experience, and establishes the funding requirements for fiscal 2021 and later years.

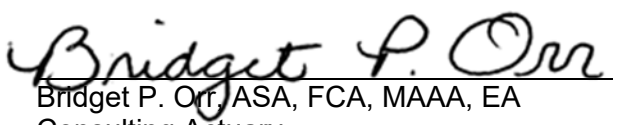
This report was prepared in accordance with generally accepted actuarial principles and practices at the request of the Board to assist in administering the Retirement System. The census information and financial information on which our calculations were based was prepared by the staff of the Middlesex County Retirement System. That assistance is gratefully acknowledged.

The actuarial calculations were directed under the supervision of Kathleen A. Riley. She is a member of the American Academy of Actuaries and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein. To the best of her knowledge, the information supplied in this actuarial valuation is complete and accurate. Further, in her opinion, the assumptions as approved by the Board are reasonably related to the experience of and the expectations for the Dedham Contributory Retirement System.

We look forward to reviewing this report at your next meeting and to answering any questions.

Sincerely,
Segal

Kathleen A. Riley, FSA, MAAA, EA
Senior Vice President and Actuary



Bridget P. Orr, ASA, FCA, MAAA, EA
Consulting Actuary

Andrew R. Luongo
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Section 1: Actuarial Valuation Summary

Purpose and basis

This report was prepared by Segal to present a valuation of the Middlesex County Retirement System as of January 1, 2020. The valuation was performed to determine whether the assets and contributions are sufficient to provide the prescribed benefits. The measurements shown in this actuarial valuation may not be applicable for other purposes. In particular, the measures herein are not necessarily appropriate for assessing the sufficiency of System assets to cover the estimated cost of settling the System's benefit obligations. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law.

The contribution requirements presented in this report are based on:

- The benefit provisions of Massachusetts General Law Chapter 32;
- The characteristics of covered active participants, inactive participants, and retired participants and beneficiaries as of December 31, 2019, provided by the staff of the Retirement System;
- The assets of the System as of December 31, 2019, provided by the staff of the Retirement System;
- Economic assumptions regarding future salary increases and investment earnings;
- Other actuarial assumptions regarding employee terminations, retirement, death, etc. and

Certain disclosure information required by GASB Statements No 67 and 68 as of December 31, 2019 for the Retirement System is provided in a separate report.

Valuation highlights

1. It is important to note that this actuarial valuation is based on plan assets as of December 31, 2019. Due to the COVID-19 pandemic, market conditions have changed significantly since the valuation date. The System's actuarial status does not reflect short-term fluctuations of the market, but rather is based on the market values on the last day of the plan year. While it is impossible to determine how the markets will perform over the next several months, and how that will affect the results of next year's valuation, Segal is available to prepare projections of potential outcomes upon request.
2. Segal strongly recommends an actuarial funding method that targets 100% funding of the actuarial accrued liability. Generally, this implies payments that are ultimately at least enough to cover normal cost, interest on the unfunded actuarial accrued liability and the principal balance. The funding policy adopted by the Middlesex County Retirement Board meets this standard and funds the unfunded actuarial accrued liability by June 30, 2037.
3. The funded ratio (the ratio of the actuarial value of assets to actuarial accrued liability) is 48.13%, compared to the prior year funded ratio of 47.87%. This ratio is one measure of funding status, and its history is a measure of funding progress. Using the market value of assets, the funded ratio is 49.45%, compared to 49.27% as of the prior valuation date. These measurements are not necessarily appropriate for assessing the sufficiency of System assets to cover the estimated cost of settling the Middlesex County Retirement System's benefit obligation or the need for or the amount of future contributions.
4. The rate of return on the market value of assets was -2.25% and 15.40% for the plan years ended December 31, 2018 and December 31, 2019, respectively. The rate of return on the actuarial value of assets (which gradually recognizes market fluctuations) was 5.76% and 6.87% for the plan years ended December 31, 2018 and December 31, 2019, respectively. This resulted in an actuarial loss when measured against the assumed rate of return of 7.50%. Given the low fixed income interest rate environment, target asset allocation and expectations of future investment returns for various classes, the Board has lowered the assumed long-term rate of return on investments to 7.30%. Changing this assumption increased the unfunded liability by approximately $65.0 million and increased the normal cost by approximately $3.0 million.
5. The actuarial value of assets as of December 31, 2019 was $1.52 billion, or 97.33% of the market value of assets of $1.57 billion reported in the Annual Statement. As of December 31, 2017, the actuarial value of assets was 97.15% of the market value.
6. The investment experience in the past years has only been partially recognized in the actuarial value of assets. As the deferred net gain of $41.8 million is recognized in future years, the cost of the Retirement System is likely to decrease unless the net gain is offset by future experience. This implies that earning the assumed rate of investment return (net of expenses) on a market value basis will result in investment gains on the actuarial value of assets in the next few years. The deferred investment gains are not recognized in the projection of the unfunded actuarial accrued liability in the funding schedule shown in *Section 2*.

Section 1: Actuarial Valuation Summary

7. As permitted by Section 19 of Chapter 188 of the Acts of 2010, the Cost of Living Adjustment base was increased to $16,000 as of July 1, 2019.

   This change to the COLA base increased the unfunded liability by approximately $29.2 million and increased the normal cost by approximately $642,000.

8. The unfunded liability was expected to increase by $10.5 million from $1,458.5 million as of January 1, 2018 to $1,469.0 million as of January 1, 2020. The actual unfunded liability of $1,641.8 million is $172.8 million greater than expected, primarily due to an experience loss and the assumption change described above. The sources of the net experience loss are detailed in Section 2.

9. The funding schedule included in this report fully funds the System by fiscal 2037, two years later than the prior funding schedule. In fiscal 2022 through fiscal 2028, the appropriation increases 6.5% per year. Thereafter, the amortization payment on the unfunded liability will increase 4.0% per year. With the prior funding schedule, the appropriation increased 6.5% per year through 2027 and thereafter, the amortization payment on the unfunded liability increased 4.0%.

10. Since the actuarial valuation results are dependent on a given set of assumptions, there is a risk that emerging results may differ significantly as actual experience proves to be different from the assumptions. We have not been engaged to perform a detailed analysis of the potential range of the impact of risk relative to the System's future financial condition, but have included a brief discussion of some risks that may affect the System in Section 2. A more detailed assessment would provide the Board with a better understanding of the inherent risks.

Summary of key valuation results

		2020	2018
Contributions for fiscal year beginning July 1:	• Actuarially Determined Contributions for fiscal year 2021 and 2019	$137,847,583	$121,534,601
	• Actuarially Determined Contributions for fiscal year 2022 and 2020	146,807,676	129,434,350
	• Actuarially Determined Contributions for fiscal year 2023 and 2021	156,350,175	137,847,583
Actuarial accrued liability for plan year Beginning January 1:	• Retired participants and beneficiaries	$1,650,074,999	$1,417,545,709
	• Inactive vested participants	44,546,428	34,368,739
	• Inactive participants due a refund of employee contributions	19,938,302	16,499,876
	• Active participants	1,451,024,547	1,329,121,646
	• Total	3,165,584,276	2,797,535,970
	• Normal cost including administrative expenses for plan year beginning January 1	77,091,386	68,115,910
Assets for plan year beginning January 1:	• Market value of assets (MVA)	$1,565,528,261	$1,378,351,219
	• Actuarial value of assets (AVA)	1,523,736,765	1,339,085,622
	• Actuarial value of assets as a percentage of market value of assets	97.33%	97.15%
Funded status for plan year beginning January 1:	• Unfunded actuarial accrued liability on market value of assets	$1,600,056,015	$1,419,184,751
	• Funded percentage on MVA basis	49.45%	49.27%
	• Unfunded actuarial accrued liability on actuarial value of assets	$1,641,847,511	$1,458,450,348
	• Funded percentage on AVA basis	48.13%	47.87%
Key assumptions:	• Net investment return	7.30%	7.50%
	• Long-term wage inflation rate	3.25%	3.25%
Demographic data for plan year beginning January 1:	• Number of retired participants and beneficiaries	5,862	5,531
	• Number of inactive vested participants	381	343
	• Number of inactive participants due a refund of employee contributions	3,082	2,771
	• Number of active participants	9,282	9,168
	• Total payroll[1]	$492,109,775	$451,777,105
	• Average payroll	53,018	49,278

[1] Payroll figures are for the prior year and reflect annualized salaries for participants hired during the year.

Important information about actuarial valuations

An actuarial valuation is a budgeting tool with respect to the financing of future projected obligations of a pension plan. It is an estimated forecast – the actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.

In order to prepare a valuation, Segal relies on a number of input items. These include:

Plan of benefits	Plan provisions define the rules that will be used to determine benefit payments, and those rules, or the interpretation of them, may change over time. Even where they appear precise, outside factors may change how they operate. It is important to keep Segal informed with respect to plan provisions and administrative procedures, and to review the plan summary included in our report to confirm that Segal has correctly interpreted the plan of benefits.
Participant data	An actuarial valuation for a plan is based on data provided to the actuary by the Retirement System. Segal does not audit such data for completeness or accuracy, other than reviewing it for obvious inconsistencies compared to prior data and other information that appears unreasonable. It is important for Segal to receive the best possible data and to be informed about any known incomplete or inaccurate data.
Assets	The valuation is based on the market value of assets as of the valuation date, as provided by the Retirement System. The Retirement System uses an “actuarial value of assets” that differs from market value to gradually reflect year-to-year changes in the market value of assets in determining the contribution requirements.
Actuarial assumptions	In preparing an actuarial valuation, Segal projects the benefits to be paid to existing plan participants for the rest of their lives and the lives of their beneficiaries. This projection requires actuarial assumptions as to the probability of death, disability, withdrawal, and retirement of each participant for each year. In addition, the benefits projected to be paid for each of those events in each future year reflect actuarial assumptions as to salary increases and cost-of-living adjustments. The projected benefits are then discounted to a present value, based on the assumed rate of return that is expected to be achieved on the plan’s assets. There is a reasonable range for each assumption used in the projection and the results may vary materially based on which assumptions are selected. It is important for any user of an actuarial valuation to understand this concept. Actuarial assumptions are periodically reviewed to ensure that future valuations reflect emerging plan experience. While future changes in actuarial assumptions may have a significant impact on the reported results that does not mean that the previous assumptions were unreasonable.

Section 1: Actuarial Valuation Summary

The user of Segal's actuarial valuation (or other actuarial calculations) should keep the following in mind:

The actuarial valuation is prepared at the request of the Retirement Board. Segal is not responsible for the use or misuse of its report, particularly by any other party.
An actuarial valuation is a measurement of the plan's assets and liabilities at a specific date. Accordingly, except where otherwise noted, Segal did not perform an analysis of the potential range of future financial measures. The actual long-term cost of the plan will be determined by the actual benefits and expenses paid and the actual investment experience of the plan.
Actuarial results in this report are not rounded, but that does not imply precision.
If the Retirement Board is aware of any event or trend that was not considered in this valuation that may materially change the results of the valuation, Segal should be advised, so that we can evaluate it.
Segal does not provide investment, legal, accounting, or tax advice. Segal's valuation is based on our understanding of applicable guidance in these areas and of the plan's provisions, but they may be subject to alternative interpretations. The Retirement Board should look to their other advisors for expertise in these areas.

As Segal has no discretionary authority with respect to the management or assets of the Retirement System, it is not a fiduciary in its capacity as actuaries and consultants with respect to the System.

Section 2: Actuarial Valuation Results

Participant data

The Actuarial Valuation and Review considers the number and demographic characteristics of covered participants, including active participants, inactive participants, retired participants and beneficiaries.

This section presents a summary of significant statistical data on these participant groups.

More detailed information for this valuation year and the preceding valuation can be found in *Section 4, Exhibits A* and *B*.

Participant Population: 2001 – 2019

Year Ended December 31	Active Participants	Inactive Participants	Retired Participants and Beneficiaries	Total Non-Actives	Ratio of Non-Actives to Actives
2001	9,246	2,331	4,481	6,812	0.74
2003	9,043	2,913	4,780	7,693	0.85
2005	9,106	3,158	4,763	7,921	0.87
2007	9,285	3,267	4,764	8,031	0.86
2009	9,093	3,430	4,833	8,263	0.91
2011	8,979	3,102	4,886	7,988	0.89
2013	9,082	3,016	5,077	8,093	0.89
2015	9,072	2,961	5,327	8,288	0.91
2017	9,168	3,114	5,531	8,644	0.94
2019	9,282	3,463	5,862	9,325	1.00

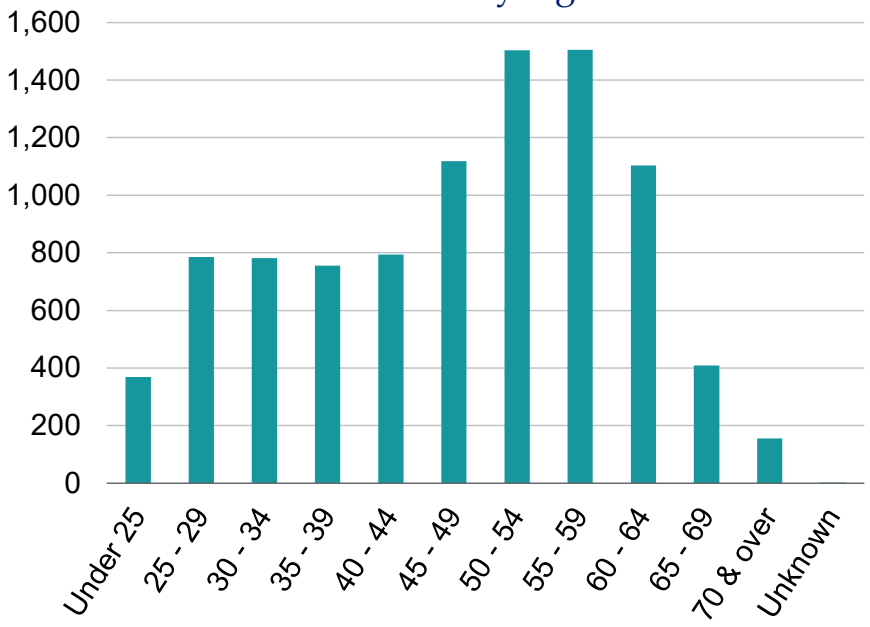
Active participants

Plan costs are affected by the age, years of service and payroll of active participants. In this year's valuation, there were 9,282 active participants with an average age of 47.9, average years of service of 11.2 years and average payroll of $53,018. The 9,168 active participants in the prior valuation had an average age of 48.1, average service of 11.5 years and average payroll of $49,278.

Among the active participants, there were 2 participants with unknown age. The actuarial calculations were adjusted for the missing information by assuming that it was the same as information provided for other active participants with similar known characteristics.

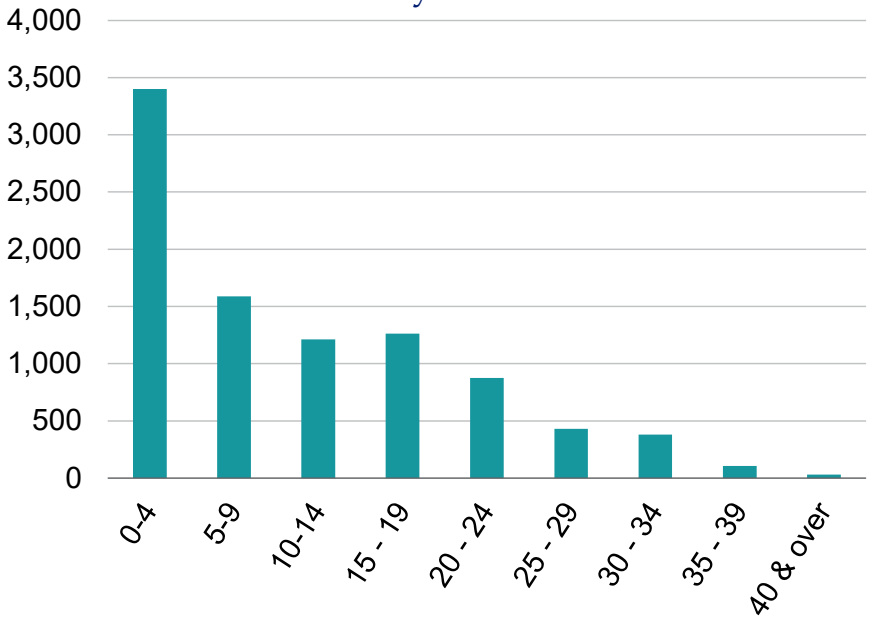
Distribution of Active Participants as of December 31, 2019

Actives by Age



Average age	47.9
Prior year average age	48.1
Difference	-0.2

Actives by Years of Service



Average years of service	11.2
Prior year average years of service	11.5
Difference	-0.3

Inactive participants

In this year's valuation, there were 381 participants with a vested right to a deferred or immediate vested benefit and 3,082 participants entitled to a return of their employee contributions.

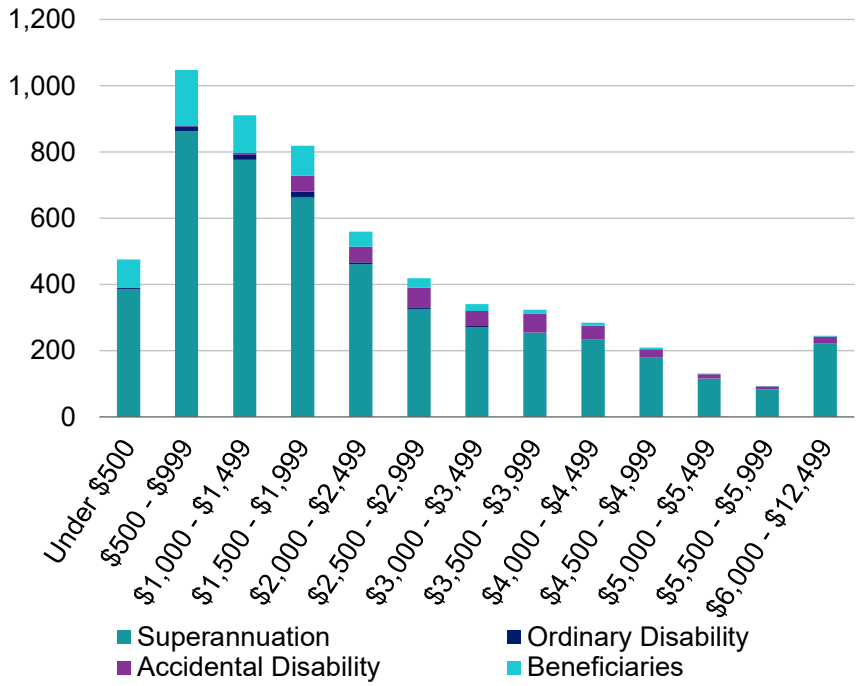
Retired participants and beneficiaries

As of December 31, 2019, 5,278 retired participants and 584 beneficiaries were receiving total monthly benefits of $13,430,415, excluding COLAs reimbursed by the Commonwealth. For comparison, in the previous valuation, there were 4,965 retired participants and 566 beneficiaries receiving monthly benefits of $11,848,656, excluding COLAs reimbursed by the Commonwealth.

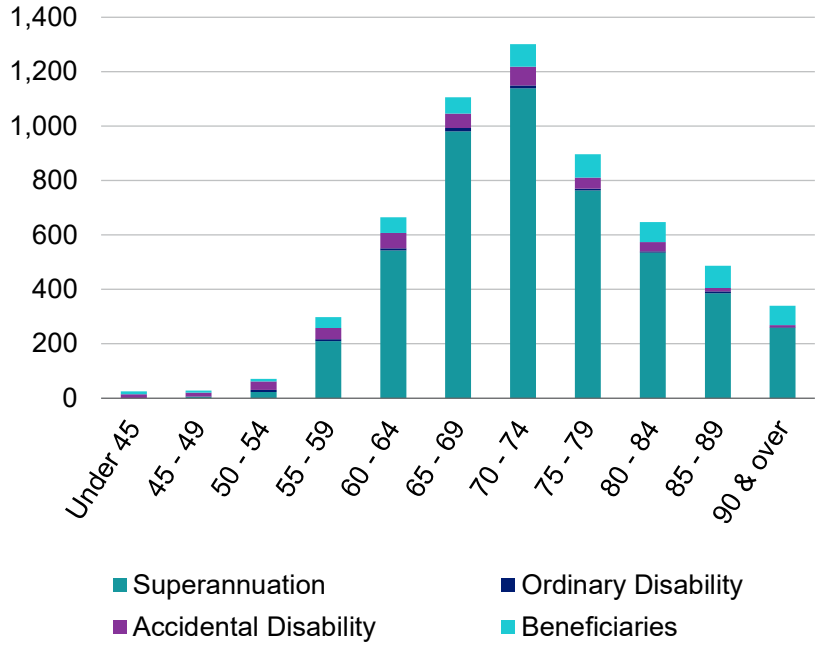
As of December 31, 2019, the average monthly benefit for retired participants and beneficiaries is $2,291, compared to $2,142 in the previous valuation. The average age for retired participants and beneficiaries is 73.0 in the current valuation, compared with 73.1 in the prior valuation.

Distribution of Pensioners and Beneficiaries as of December 31, 2019

By Type and Monthly Amount



By Type and Age

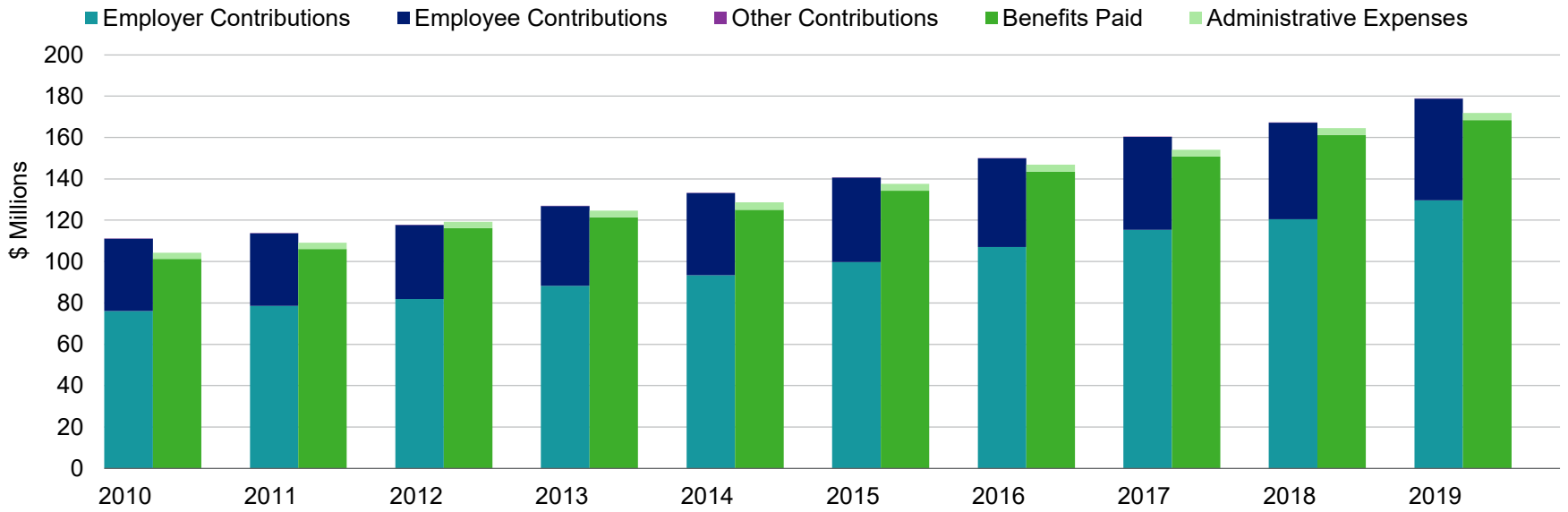


Financial information

Retirement plan funding anticipates that, over the long term, both contributions (less administrative expenses) and investment earnings (less investment fees) will be needed to cover benefit payments. Retirement plan assets change as a result of the net impact of these income and expense components.

Additional financial information, including a summary of transactions for the valuation year, is presented in *Section 4, Exhibit C*.

Comparison of Contributions with Benefits and Expenses
for Years Ended December 31, 2010 – 2019



Section 2: Actuarial Valuation Results

It is desirable to have level and predictable plan costs from one year to the next. For this reason, the Board has approved an asset valuation method that gradually adjusts to market value. Under this valuation method, the full value of market fluctuations is not recognized in a single year and, as a result, the asset value and the plan costs are more stable. The amount of the adjustment to recognize market value is treated as income, which may be positive or negative. Realized and unrealized gains and losses are treated equally and, therefore, the sale of assets has no immediate effect on the actuarial value.

Determination of Actuarial Value of Assets

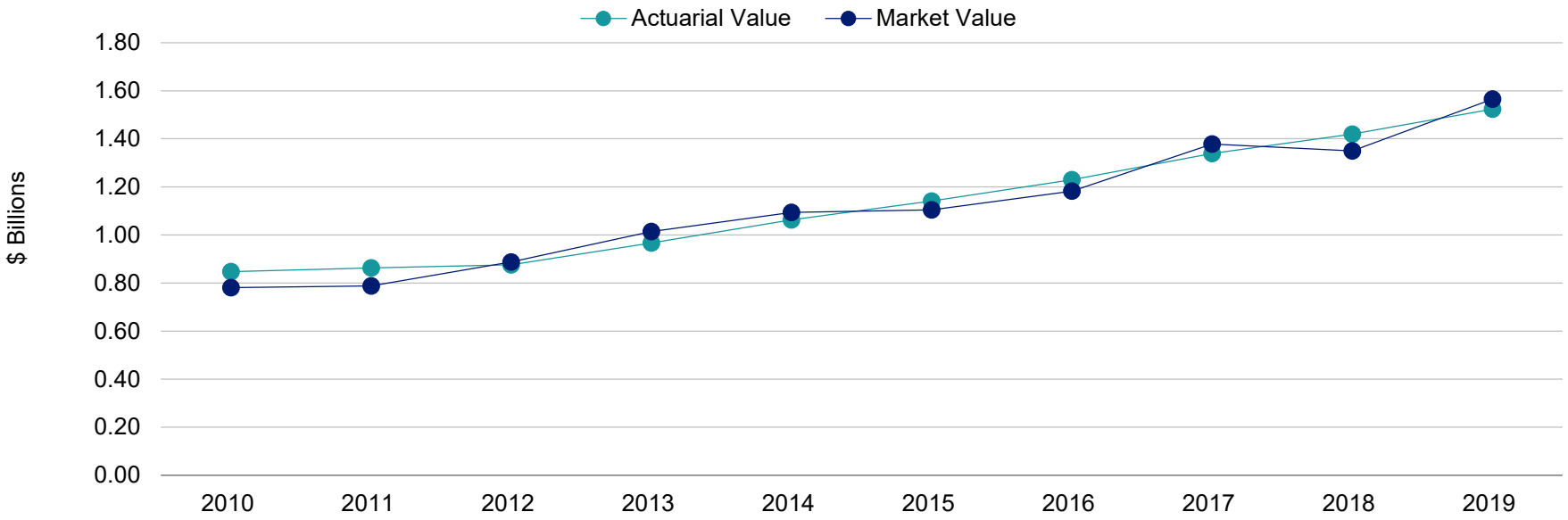
				Year Ended	
				December 31, 2019	December 31, 2018
1	Market value of assets at the end of the year			$1,565,528,261	$1,350,039,767
2	Calculation of unrecognized return	Original Amount[1]	Percent Deferred	Unrecognized Amount[2]	Unrecognized Amount[2]
	(a) Year ended December 31, 2019	$106,954,044	80%	$85,563,235	N/A
	(b) Year ended December 31, 2018	-134,459,875	60%	-80,675,925	-$107,567,900
	(c) Year ended December 31, 2017	97,658,911	40%	39,063,564	58,595,346
	(d) Year ended December 31, 2016	-10,796,891	20%	-2,159,378	-4,318,756
	(e) Year ended December 31, 2015	-78,422,911	0%	0	-15,684,582
	(f) Total unrecognized return			$41,791,496	-$68,975,892
3	Preliminary actuarial value: (1) - (2f)			1,523,736,765	1,419,015,659
4	Adjustment to be within 20% corridor			0	0
5	Final actuarial value of assets as of December 31, 2019: (3) + (4)			1,523,736,765	1,419,015,659
6	Actuarial value as a percentage of market value: (5) ÷ (1)			97.33%	105.11%
7	Amount deferred for future recognition: (1) - (5)			$41,791,496	-$68,975,892

[1] Total return minus expected return on a market value basis.
[2] Recognition at 20% per year over five years.

Section 2: Actuarial Valuation Results

Both the actuarial value and market value of assets are representations of the Middlesex County Retirement System's financial status. As investment gains and losses are gradually taken into account, the actuarial value of assets tracks the market value of assets. The actuarial asset value is significant because the Middlesex County Retirement System's liabilities are compared to these assets to determine what portion, if any, remains unfunded. Amortization of the unfunded actuarial accrued liability is an important element in determining the contribution requirement.

Actuarial Value of Assets vs. Market Value of Assets as of December 31, 2010 – 2019



Actuarial experience

To calculate any actuarially determined contribution, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year actual experience is measured against the assumptions. If overall experience is more favorable than anticipated (an actuarial gain), any contribution requirement will decrease from the previous year. On the other hand, any contribution requirement will increase if overall actuarial experience is less favorable than expected (an actuarial loss).

Taking account of experience gains or losses in one year without making a change in assumptions reflects the belief that the single year's experience was a short-term development and that, over the long term, experience will return to the original assumptions. For contribution requirements to remain stable, assumptions should approximate experience.

If assumptions are changed, the contribution requirement is adjusted to take into account a change in experience anticipated for all future years.

The net experience loss is $78,703,265, which includes $32,260,002 from investment losses and $46,443,263 in losses from all other sources. The net experience variation from individual sources other than investments was 1.5% of the actuarial accrued liability. A discussion of the major components of the actuarial experience is on the following pages.

Actuarial Experience for Two-Year Period Ended December 31, 2019

1	Net loss from investments	-$32,260,002
2	Net gain from administrative expenses	651,816
3	Net loss from other experience	-47,095,079
4	Net experience loss: **1 + 2 + 3**	-$78,703,265

Investment experience

A major component of projected asset growth is the assumed rate of return. The assumed return should represent the expected long-term rate of return, based on the Middlesex County Retirement System's investment policy. The rate of return on the market value of assets for the 2019 and 2018 plan years was 15.40% and -2.25%, respectively.

For valuation purposes, the assumed rate of return on the actuarial value of assets was 7.50% for the 2019 and 2018 plan years. The actual rate of return on an actuarial basis was 6.87% for the 2019 plan year and 5.76% for the 2018 plan year. Since the actual return for the year was less than the assumed return, the Middlesex County Retirement System experienced an actuarial loss during the two-year period ending December 31, 2019 with regard to its investments.

Investment Experience

		Year Ended December 31, 2019		Year Ended December 31, 2018	
		Market Value	**Actuarial Value**	**Market Value**	**Actuarial Value**
1	Net investment income	$208,470,212	$97,702,824	-$30,983,338	$77,258,151
2	Average value of assets	1,353,548,908	1,422,524,800	1,379,687,162	1,340,421,565
3	Rate of return: **1 ÷ 2**	15.40%	6.87%	-2.25%	5.76%
4	Assumed rate of return	7.50%	7.50%	7.50%	7.50%
5	Expected investment income: **2 x 4**	$101,516,168	$106,689,360	$103,476,537	$100,531,617
6	Actuarial gain/(loss): **1 - 5**	$106,954,044	-$8,986,536	-$134,459,875	-$23,273,466

Section 2: Actuarial Valuation Results

Because actuarial planning is long term, it is useful to see how the assumed investment rate of return has followed actual experience over time. The chart below shows the rate of return on an actuarial basis compared to the actual market value investment return for the last 14 years, including averages over select time periods. Based on this experience and future expectations, we have lowered the assumed rate of return from 7.50% to 7.30%.

Investment Return – Actuarial Value vs. Market Value: 2006 - 2019

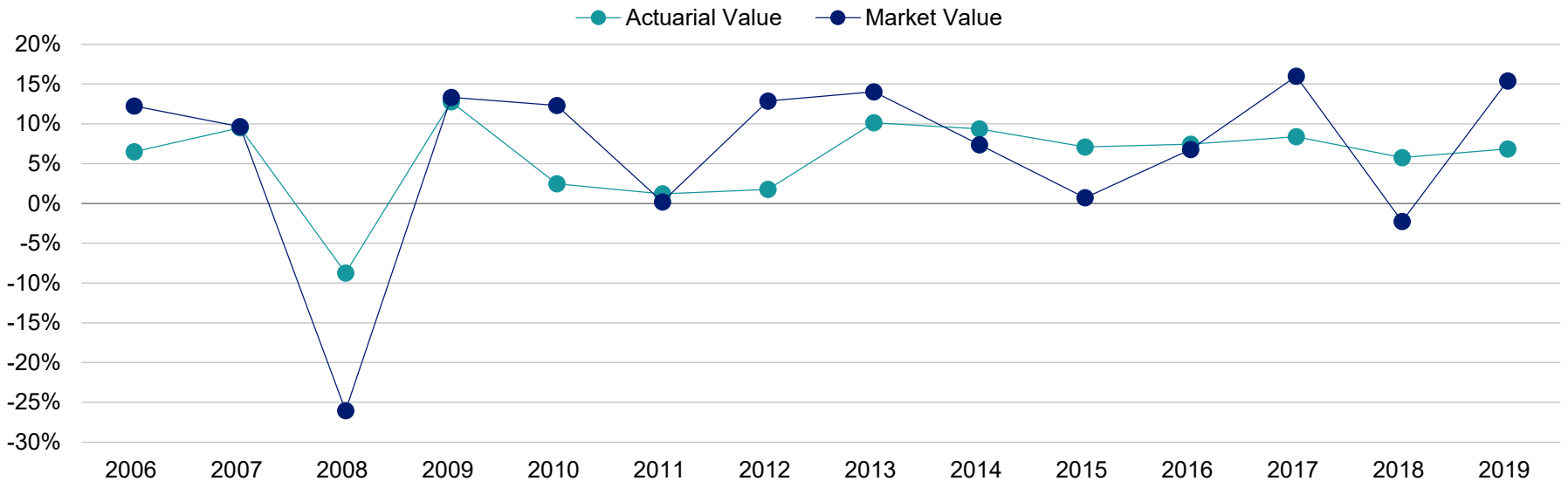
Year Ended December 31	Actuarial Value Investment Return		Market Value Investment Return		Year Ended December 31	Actuarial Value Investment Return		Market Value Investment Return	
	Amount	Percent	Amount	Percent		Amount	Percent	Amount	Percent
2006	$42,522,819	6.49%	$78,230,492	12.26%	2013	$88,945,014	10.14%	$124,783,005	14.05%
2007	67,081,999	9.53	69,754,061	9.66	2014	90,787,044	9.36	74,962,895	7.38
2008	-68,010,444	-8.73	-208,326,323	-26.04	2015	75,500,265	7.10	7,817,250	0.71
2009	92,107,036	12.77	80,318,175	13.34	2016	85,250,906	7.46	74,917,549	6.77
2010	20,487,695	2.49	85,309,569	12.32	2017	103,305,254	8.38	189,543,974	15.99
2011	10,333,913	1.22	1,488,563	0.19	2018	77,258,151	5.76	-30,983,338	-2.25
2012	15,213,243	1.77	101,170,082	12.86	2019	97,702,824	6.87	208,470,212	15.40
					Most recent five-year average return		7.08%		7.35%
					Most recent ten-year average return		6.28%		8.14%
					Most recent 14-year average return		5.94%		6.57%

Note: Each year's yield is weighted by the average asset value in that year.

Section 2: Actuarial Valuation Results

As described earlier in this section, the actuarial asset valuation method gradually recognizes fluctuations in the market value rate of return. The goal of this is to stabilize the actuarial rate of return and to produce more level pension plan costs.

Market and Actuarial Rates of Return for Years Ended December 31, 2006 - 2019



Non-investment experience

Administrative expenses

- Administrative expenses for the years ended December 31, 2018 and 2019 totaled $3,273,735 and $3,352,400, respectively, as compared to the assumption of $3,500,000 for calendar year 2018 and $3,613,750 for calendar year 2019. This resulted in a gain of $651,816 for the two-year period, including an adjustment for interest. Based on information on expenses provided by the Retirement System, we have reset the assumption to $3,500,000 for calendar year 2020.

Mortality experience

- Mortality experience (more or fewer than expected deaths) yields actuarial gains or losses.
- The number of deaths for nondisabled pensioners over the past two years was 328 compared to 315.3 projected deaths. The number of deaths for disabled pensioners over the past two years was 29 compared to 23.8 projected deaths. The number of deaths for beneficiaries over the past two years was 61 compared to 56.0 projected deaths.

Other experience

There are other differences between the expected and the actual experience that appear when the new valuation is compared with the projections from the previous valuation. These include:

- the extent of turnover among participants,
- retirement experience (earlier or later than projected),
- the number of disability retirements (more or fewer than projected), and
- salary increases (greater or smaller than projected).

The net loss from this other experience for the two-year period ending December 31, 2019 amounted to $47,095,079, which is 1.5% of the actuarial accrued liability.

Liability Changes Due to Demographic Experience for Two-Year Period Ended December 31, 2019

Loss due to salaries increasing more than expected	-$7,565,290
Loss due to mortality experience	-7,128,934
Increase in liability due to new active participants	-30,966,667
Miscellaneous experience loss	-1,434,188
Total	-$47,095,079

Actuarial assumptions

The assumption changes reflected in this report are:

- The net investment return assumption was lowered from 7.50% to 7.30%.
- The administrative expense assumption was reset from $3,500,000 for calendar 2018, increasing 3.25% per year to $3,500,000 for calendar 2020, increasing 3.25% per year.

Changing these assumptions increased the unfunded liability by approximately $65.0 million and increased the normal cost by approximately $3.0 million.

Details on actuarial assumptions and methods are in *Section 5, Exhibit I*.

Plan provisions

As permitted by Section 19 of Chapter 188 of the Acts of 2010, the Cost of Living Adjustment base was increased to $16,000 as of July 1, 2019. This change to the COLA base increased the unfunded liability by approximately $29.2 million and increased the normal cost by approximately $642,000.

A summary of plan provisions is in *Section 5, Exhibit II.*

Section 2: Actuarial Valuation Results

Development of Unfunded Actuarial Accrued Liability

		Year Ended	
		December 31, 2019	December 31, 2018
1	Unfunded actuarial accrued liability at beginning of year	$1,468,180,662	$1,458,450,348
2	Normal cost at beginning of year	70,329,677	68,115,910
3	Total contributions	-178,856,685	-167,205,425
4	Interest		
	• For whole year on **1 + 2**	$115,388,275	$114,492,469
	• For half year on **3**	-6,067,923	-5,672,640
	Total interest	109,320,352	108,819,829
5	Expected unfunded actuarial accrued liability	$1,468,974,007	$1,468,180,662
6	Changes due to:		
	• Net loss from investments	$32,260,002	- -
	• Net loss from other experience	46,443,263	- -
	• Increase from change in assumptions	65,013,900	- -
	• Increase from changes in COLA base	29,156,339	- -
	Total changes	172,873,504	- -
7	Unfunded actuarial accrued liability at end of year	$1,641,847,511	- -

Actuarially determined contribution

The Actuarially Determined Contribution is equal to the employer normal cost payment and a payment on the unfunded actuarial accrued liability. For fiscal 2021, the Actuarially Determined Contribution has been set equal to the previously budgeted amount of $137,847,583. The detail of the Actuarially Determined Contribution is shown below.

The funding schedule included in this report fully funds the System by fiscal 2037, two years later than the prior funding schedule. In fiscal 2022 through fiscal 2028, the appropriation increases 6.5% per year. Thereafter, the amortization payment on the unfunded liability will increase 4.0% per year. With the prior funding schedule, the appropriation increased 6.5% per year through 2027 and thereafter, the amortization payment on the unfunded liability increased 4.0%.

Actuarially Determined Contribution for Year Beginning January 1

		2020		2018	
		Amount	% of Projected Payroll	Amount	% of Projected Payroll
1	Total normal cost	$73,591,386	14.34%	$64,615,910	13.72%
2	Administrative expenses	3,500,000	0.68%	3,500,000	0.74%
3	Expected employee contributions	-50,243,061	-9.79%	-45,566,198	-9.67%
4	Employer normal cost: **(1) + (2) + (3)**	$26,848,325	5.23%	$22,549,712	4.79%
5	Actuarial accrued liability	$3,165,584,276		$2,797,535,970	
6	Actuarial value of assets	1,523,736,765		1,339,085,622	
7	Unfunded actuarial accrued liability: **(5) - (6)**	$1,641,847,511		$1,458,450,348	
8	Employer normal cost projected to July 1, 2020 and 2018, adjusted for timing	27,765,926	5.32%	23,331,257	4.87%
9	Projected unfunded actuarial accrued liability	1,700,719,456		1,512,153,505	
10	Payment on projected unfunded actuarial accrued liability, adjusted for timing	110,081,657	21.11%	98,203,344	20.51%
11	Actuarially determined contribution: **(8) + (10)**	$137,847,583	26.43%	$121,534,601	25.39%
12	Projected payroll as of July 1	$521,474,124		$478,709,596	

Notes:
Actuarially Determined Contributions are assumed to be paid on July 1 and December 31.
Actuarially Determined Contributions are set equal to the budgeted amounts determined with the prior valuation.

Funding schedule

(1) Fiscal year ended June 30:	(2) Employer Normal Cost	(3) Amortization of 2010 ERI Liability	(4) Amortization of Remaining Unfunded Liability	(5) Actuarially Determined Contribution (ADC): (2) + (3) + (4)	(6) Total Unfunded Actuarial Accrued Liability at Beginning of Fiscal Year	(7) Percent Increase in ADC Over Prior Year
2021	$27,765,926	$60,290	$110,021,367	$137,847,583	$1,700,719,456	- -
2022	28,786,188	60,291	117,961,197	146,807,676	1,708,816,737	6.50%
2023	29,843,623	0	126,506,552	156,350,175	1,709,134,434	6.50%
2024	30,939,574	0	135,573,362	166,512,936	1,700,529,817	6.50%
2025	32,075,434	0	145,260,843	177,336,277	1,681,738,242	6.50%
2026	33,252,648	0	155,610,487	188,863,135	1,651,361,710	6.50%
2027	34,472,710	0	166,666,529	201,139,239	1,607,856,424	6.50%
2028	35,737,168	0	178,476,122	214,213,290	1,549,519,254	6.50%
2029	37,047,627	0	188,320,724	225,368,351	1,474,473,030	5.21%
2030	38,405,750	0	195,853,553	234,259,303	1,383,569,612	3.95%
2031	39,813,257	0	203,687,695	243,500,952	1,278,088,646	3.95%
2032	41,271,934	0	211,835,203	253,107,137	1,156,648,308	3.95%
2033	42,783,626	0	220,308,611	263,092,237	1,017,753,193	3.95%
2034	44,350,249	0	229,120,955	273,471,204	859,785,517	3.94%
2035	45,973,785	0	238,285,793	284,259,578	680,995,655	3.94%
2036	47,656,289	0	247,817,225	295,473,514	479,491,965	3.94%
2037	49,399,886	0	257,729,914	307,129,800	253,229,850	3.94%
2038	51,206,783	0	0	51,206,783	0	-83.33%

Notes:
Fiscal 2021 Actuarially Determined Contribution set to budgeted amount.
Actuarially Determined Contributions are assumed to be paid on July 1 and December 31.
Item (2) reflects 3.25% growth in payroll, plus an additional 0.15% adjustment to total normal cost to reflect the effects of mortality improvement due to generational mortality assumption.
Item (3) reflects level dollar amortization.
Item (4) increases 4% per year beginning in fiscal 2030.
Projected normal cost does not reflect the impact of pension reform for future hires.
Projected unfunded actuarial accrued liability does not reflect the recognition of deferred investment gains.

Risk

Since the actuarial valuation results are dependent on a given set of assumptions and data as of a specific date, there is a risk that emerging results may differ significantly as actual experience differs from the assumptions.

This report does not contain a detailed analysis of the potential range of future measurements, but does include a brief discussion of some risks that may affect the Retirement System. We recommend a more detailed assessment to provide the Board with a better understanding of the risks inherent in the Retirement System. This assessment may include scenario testing, sensitivity testing, stress testing and stochastic modeling.

- Investment Risk (the risk that returns will be different than expected)

  The market value rate of return over the last 14 years has ranged from a low of -26.04% to a high of 15.99%.

  As an illustration of the sensitivity of future employer contributions to investment volatility, we have estimated the impact of a 0% return in 2020 on the funding schedule that would be developed with the next valuation. Because the actuarial value of assets is used, only 40% of the 2020 investment loss will be recognized as of January 1, 2022. If all assumptions other than the investment return assumption for 2020 are met, we estimate that the funding schedule included in next year's valuation report would reflect appropriations that increase 6.50% per year through fiscal 2030, compared with 6.50% increases through fiscal 2028 in the current funding schedule, if the current full funding date of 2037 is maintained. Please note that this estimate assumes that any deferred investment losses as of January 1, 2022 are not recognized in the projection of the unfunded actuarial accrued liability in the funding schedule.

- Longevity Risk (the risk that mortality experience will be different than expected)

  The actuarial valuation includes an expectation of future improvement in life expectancy. Emerging plan experience that does not match these expectations will result in either an increase or decrease in the actuarially determined contribution.

- Contribution Risk (the risk that actual contributions will be different from actuarially determined contribution)

  Massachusetts General Law Chapter 32 requires payment of the actuarially determined contribution. If future experience matches current assumptions, we project the unfunded actuarial accrued liability will be paid off in seventeen years.

Section 2: Actuarial Valuation Results

- Demographic Risk (the risk that participant experience will be different than assumed)

  Examples of this risk include:

  – Actual retirements occurring earlier or later than assumed.
  – More or less active participant turnover than assumed.
  – Disability experience greater or less than expected.
  – Salary increases greater or less than projected.

- Actual Experience in Recent Years and Implications for the Future

  Past experience can help demonstrate the sensitivity of key results to the Plan's actual experience. Over the past ten years:

  The investment gain(loss) for a year has ranged from a loss of $134,459,875 to a gain of $106,954,044.

  The non-investment gain(loss) for a year has ranged from a loss of $46,443,263 to a gain of $16,974,209.

  The funded percentage on the actuarial value of assets has ranged from a low of 43.7% as of January 1, 2012 to a high of 48.1% as of January 1, 2020.

- Maturity Measures

  As pension plans mature, the cash need to fulfill benefit obligations will increase over time. Therefore, cash flow projections and analysis should be performed to assure that the Plan's asset allocation is aligned to meet emerging pension liabilities.

  In 2019, benefits paid and administrative expenses were $7,018,282 less than contributions received. As the Retirement System matures, cash may needed from the investment portfolio to meet benefit payments.

Section 3: Unit Results

Summary of Actuarial Valuation Results

			Total
The valuation was made with respect to the following data supplied to us:			
1	Retired participants as of the valuation date (including 584 beneficiaries in pay status)		5,862
2	Participants active during the year ended December 31, 2019		9,282
3	Inactive participants entitled to a return of their employee contributions		3,082
4	Inactive participants with a vested right to a deferred or immediate benefit		381
The actuarial factors as of January 1, 2020 are as follows:			
1	Normal cost		$73,591,386
2	Administrative expenses		3,500,000
3	Expected employee contributions		-50,243,061
4	Employer normal cost: **(1) + (2) + (3)**		$26,848,325
5	Actuarial accrued liability		3,165,584,276
	Retired participants and beneficiaries	$1,650,074,999	
	Active participants	1,451,024,547	
	Inactive participants	64,484,730	
6	Actuarial value of assets		1,523,736,765
7	Unfunded actuarial accrued liability: **(5) – (6)**		1,641,847,511
8	Reallocated unfunded actuarial accrued liability		0
9	Total unfunded actuarial accrued liability: **(7) + (8)**		$1,641,847,511
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1	Projected employer normal cost	$27,765,926	5.32%
2	Projected unfunded actuarial accrued liability	1,700,719,456	
3	Payment on projected unfunded actuarial accrued liability	110,021,367	
4	Payment on 2010 ERI	60,290	
5	Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$137,847,583	26.43%
6	Total FY21 Actuarially Determined Contribution, payable on July 1	135,377,672	25.96%
7	Projected payroll	521,474,125	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1	Projected employer normal cost	$28,786,188	$29,843,623
2	Payment on projected unfunded actuarial accrued liability	117,961,197	126,506,552
3	Payment on 2010 ERI	60,291	0
4	Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$146,807,676	$156,350,175
5	Total Actuarially Determined Contribution, payable on July 1	144,244,359	153,620,238

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Middlesex County Retirement Board			1
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			15
2 Participants active during the year ended December 31, 2019			17
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$154,834
2 Administrative expenses			7,364
3 Expected employee contributions			-139,375
4 Employer normal cost: **(1) + (2) + (3)**			$22,823
5 Actuarial accrued liability			10,905,301
Retired participants and beneficiaries	$5,158,079		
Active participants	5,747,222		
Inactive participants	0		
6 Actuarial value of assets			5,295,013
7 Unfunded actuarial accrued liability: **(5) – (6)**			5,610,288
8 Reallocated unfunded actuarial accrued liability			78,665
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$5,688,953
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$23,603	1.66%
2 Projected unfunded actuarial accrued liability		5,892,943	
3 Payment on projected unfunded actuarial accrued liability		339,231	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$362,834	25.49%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		356,333	25.03%
7 Projected payroll		1,423,679	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$24,618	$25,675
2 Payment on projected unfunded actuarial accrued liability		411,817	441,650
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$436,435	$467,325
5 Total Actuarially Determined Contribution, payable on July 1		428,815	459,165

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Middlesex County			**100**
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 35 beneficiaries in pay status)			99
2 Participants active during the year ended December 31, 2019			0
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$0
2 Administrative expenses			0
3 Expected employee contributions			0
4 Employer normal cost: **(1) + (2) + (3)**			$0
5 Actuarial accrued liability			13,908,271
Retired participants and beneficiaries	$13,908,271		
Active participants	0		
Inactive participants	0		
6 Actuarial value of assets			0
7 Unfunded actuarial accrued liability: **(5) – (6)**			13,908,271
8 Reallocated unfunded actuarial accrued liability			-13,908,271
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$0
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$0	0.00%
2 Projected unfunded actuarial accrued liability		0	
3 Payment on projected unfunded actuarial accrued liability		0	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$0	0.00%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		0	0.00%
7 Projected payroll		0	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22		FY23
1 Projected employer normal cost	$0		$0
2 Payment on projected unfunded actuarial accrued liability	0		0
3 Payment on 2010 ERI	0		0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$0		$0
5 Total Actuarially Determined Contribution, payable on July 1	0		0

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Middlesex Hospital			200
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 4 beneficiaries in pay status)			69
2 Participants active during the year ended December 31, 2019			0
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$0
2 Administrative expenses			0
3 Expected employee contributions			0
4 Employer normal cost: **(1) + (2) + (3)**			$0
5 Actuarial accrued liability			8,762,986
Retired participants and beneficiaries	$8,762,986		
Active participants	0		
Inactive participants	0		
6 Actuarial value of assets			0
7 Unfunded actuarial accrued liability: **(5) – (6)**			8,762,986
8 Reallocated unfunded actuarial accrued liability			-8,762,986
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$0
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$0	0.00%
2 Projected unfunded actuarial accrued liability		0	
3 Payment on projected unfunded actuarial accrued liability		0	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$0	0.00%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		0	0.00%
7 Projected payroll		0	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22		FY23
1 Projected employer normal cost	$0		$0
2 Payment on projected unfunded actuarial accrued liability	0		0
3 Payment on 2010 ERI	0		0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$0		$0
5 Total Actuarially Determined Contribution, payable on July 1	0		0

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Acton		300
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 21 beneficiaries in pay status)		185
2 Participants active during the year ended December 31, 2019		195
3 Inactive participants entitled to a return of their employee contributions		29
4 Inactive participants with a vested right to a deferred or immediate benefit		8
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,206,788
2 Administrative expenses		104,955
3 Expected employee contributions		-1,508,969
4 Employer normal cost: **(1) + (2) + (3)**		$802,774
5 Actuarial accrued liability		108,500,392
Retired participants and beneficiaries	$57,479,737	
Active participants	50,063,563	
Inactive participants	957,092	
6 Actuarial value of assets		53,045,476
7 Unfunded actuarial accrued liability: **(5) – (6)**		55,454,916
8 Reallocated unfunded actuarial accrued liability		782,663
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$56,237,579
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$830,211	5.37%
2 Projected unfunded actuarial accrued liability	58,254,097	
3 Payment on projected unfunded actuarial accrued liability	3,785,506	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$4,615,717	29.88%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	4,533,014	29.34%
7 Projected payroll	15,450,092	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$860,727	$892,356
2 Payment on projected unfunded actuarial accrued liability	4,039,534	4,332,166
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$4,900,261	$5,224,522
5 Total Actuarially Determined Contribution, payable on July 1	4,814,701	5,133,300

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Ashby		400
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)		11
2 Participants active during the year ended December 31, 2019		21
3 Inactive participants entitled to a return of their employee contributions		5
4 Inactive participants with a vested right to a deferred or immediate benefit		3
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$198,794
2 Administrative expenses		9,455
3 Expected employee contributions		-115,287
4 Employer normal cost: **(1) + (2) + (3)**		$92,962
5 Actuarial accrued liability		5,406,288
Retired participants and beneficiaries	$2,210,742	
Active participants	2,744,799	
Inactive participants	450,747	
6 Actuarial value of assets		3,405,802
7 Unfunded actuarial accrued liability: **(5) – (6)**		2,000,486
8 Reallocated unfunded actuarial accrued liability		38,998
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$2,039,484

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$96,139	8.16%
2 Projected unfunded actuarial accrued liability	2,112,614	
3 Payment on projected unfunded actuarial accrued liability	160,437	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$256,576	21.77%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	251,979	21.38%
7 Projected payroll	1,178,840	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$99,582	$103,148
2 Payment on projected unfunded actuarial accrued liability	144,811	155,301
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$244,393	$258,449
5 Total Actuarially Determined Contribution, payable on July 1	240,126	253,936

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Ashland		500
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 15 beneficiaries in pay status)		140
2 Participants active during the year ended December 31, 2019		306
3 Inactive participants entitled to a return of their employee contributions		135
4 Inactive participants with a vested right to a deferred or immediate benefit		14
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,148,389
2 Administrative expenses		102,177
3 Expected employee contributions		-1,474,801
4 Employer normal cost: **(1) + (2) + (3)**		$775,765
5 Actuarial accrued liability		80,243,259
Retired participants and beneficiaries	$40,265,771	
Active participants	37,863,144	
Inactive participants	2,114,344	
6 Actuarial value of assets		42,049,018
7 Unfunded actuarial accrued liability: **(5) – (6)**		38,194,241
8 Reallocated unfunded actuarial accrued liability		578,831
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$38,773,072

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$802,278	5.22%
2 Projected unfunded actuarial accrued liability	40,163,363	
3 Payment on projected unfunded actuarial accrued liability	2,466,282	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$3,268,560	21.25%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	3,209,995	20.87%
7 Projected payroll	15,378,258	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$831,794	$862,385
2 Payment on projected unfunded actuarial accrued liability	2,795,516	2,998,029
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$3,627,310	$3,860,414
5 Total Actuarially Determined Contribution, payable on July 1	3,563,976	3,793,010

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Ayer		600
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 14 beneficiaries in pay status)		76
2 Participants active during the year ended December 31, 2019		106
3 Inactive participants entitled to a return of their employee contributions		13
4 Inactive participants with a vested right to a deferred or immediate benefit		8
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$1,129,153
2 Administrative expenses		53,702
3 Expected employee contributions		-753,057
4 Employer normal cost: **(1) + (2) + (3)**		$429,798
5 Actuarial accrued liability		43,004,186
Retired participants and beneficiaries	$19,571,958	
Active participants	22,582,933	
Inactive participants	849,295	
6 Actuarial value of assets		22,354,199
7 Unfunded actuarial accrued liability: **(5) – (6)**		20,649,987
8 Reallocated unfunded actuarial accrued liability		310,209
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$20,960,196
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$444,487	5.78%
2 Projected unfunded actuarial accrued liability	21,711,769	
3 Payment on projected unfunded actuarial accrued liability	1,375,875	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,820,362	23.67%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	1,787,745	23.25%
7 Projected payroll	7,690,120	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$460,742	$477,586
2 Payment on projected unfunded actuarial accrued liability	1,508,115	1,617,366
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,968,857	$2,094,952
5 Total Actuarially Determined Contribution, payable on July 1	1,934,480	2,058,373

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Bedford		700
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 17 beneficiaries in pay status)		186
2 Participants active during the year ended December 31, 2019		371
3 Inactive participants entitled to a return of their employee contributions		168
4 Inactive participants with a vested right to a deferred or immediate benefit		12
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,845,288
2 Administrative expenses		135,322
3 Expected employee contributions		-1,998,175
4 Employer normal cost: **(1) + (2) + (3)**		$982,435
5 Actuarial accrued liability		114,371,929
Retired participants and beneficiaries	$52,179,138	
Active participants	60,005,099	
Inactive participants	2,187,692	
6 Actuarial value of assets		59,405,788
7 Unfunded actuarial accrued liability: **(5) – (6)**		54,966,141
8 Reallocated unfunded actuarial accrued liability		825,017
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$55,791,158

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,016,012	4.89%
2 Projected unfunded actuarial accrued liability	57,791,669	
3 Payment on projected unfunded actuarial accrued liability	3,857,920	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$4,873,932	23.47%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	4,786,602	23.05%
7 Projected payroll	20,767,767	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,053,590	$1,092,544
2 Payment on projected unfunded actuarial accrued liability	4,000,011	4,289,780
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$5,053,601	$5,382,324
5 Total Actuarially Determined Contribution, payable on July 1	4,965,363	5,288,347

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Billerica		800
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 54 beneficiaries in pay status)		455
2 Participants active during the year ended December 31, 2019		655
3 Inactive participants entitled to a return of their employee contributions		137
4 Inactive participants with a vested right to a deferred or immediate benefit		16
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$5,706,599
2 Administrative expenses		271,404
3 Expected employee contributions		-3,772,958
4 Employer normal cost: **(1) + (2) + (3)**		$2,205,045
5 Actuarial accrued liability		272,538,836
Retired participants and beneficiaries	$143,331,742	
Active participants	125,914,542	
Inactive participants	3,292,552	
6 Actuarial value of assets		114,937,058
7 Unfunded actuarial accrued liability: **(5) – (6)**		157,601,778
8 Reallocated unfunded actuarial accrued liability		1,965,950
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$159,567,728
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$2,280,407	5.81%
2 Projected unfunded actuarial accrued liability	165,289,370	
3 Payment on projected unfunded actuarial accrued liability	10,735,199	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$13,015,606	33.17%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	12,782,396	32.57%
7 Projected payroll	39,241,530	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$2,363,662	$2,449,929
2 Payment on projected unfunded actuarial accrued liability	11,462,139	12,292,478
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$13,825,801	$14,742,407
5 Total Actuarially Determined Contribution, payable on July 1	13,584,397	14,484,999

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Boxborough			900
The valuation was made with respect to the following data supplied to us:			
1	Retired participants as of the valuation date (including 3 beneficiaries in pay status)		42
2	Participants active during the year ended December 31, 2019		51
3	Inactive participants entitled to a return of their employee contributions		13
4	Inactive participants with a vested right to a deferred or immediate benefit		4
The actuarial factors as of January 1, 2020 are as follows:			
1	Normal cost		$550,873
2	Administrative expenses		26,199
3	Expected employee contributions		-351,682
4	Employer normal cost: **(1) + (2) + (3)**		$225,390
5	Actuarial accrued liability		23,254,623
	Retired participants and beneficiaries	$12,489,397	
	Active participants	10,075,764	
	Inactive participants	689,462	
6	Actuarial value of assets		10,636,765
7	Unfunded actuarial accrued liability: **(5) – (6)**		12,617,858
8	Reallocated unfunded actuarial accrued liability		167,746
9	Total unfunded actuarial accrued liability: **(7) + (8)**		$12,785,604
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1	Projected employer normal cost	$233,093	6.49%
2	Projected unfunded actuarial accrued liability	13,244,059	
3	Payment on projected unfunded actuarial accrued liability	794,228	
4	Payment on 2010 ERI	0	
5	Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,027,321	28.59%
6	Total FY21 Actuarially Determined Contribution, payable on July 1	1,008,914	28.08%
7	Projected payroll	3,593,285	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1	Projected employer normal cost	$241,551	$250,314
2	Payment on projected unfunded actuarial accrued liability	923,220	990,101
3	Payment on 2010 ERI	0	0
4	Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,164,771	$1,240,415
5	Total Actuarially Determined Contribution, payable on July 1	1,144,434	1,218,757

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Burlington			1000
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 31 beneficiaries in pay status)			373
2 Participants active during the year ended December 31, 2019			564
3 Inactive participants entitled to a return of their employee contributions			207
4 Inactive participants with a vested right to a deferred or immediate benefit			16
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$5,163,513
2 Administrative expenses			245,576
3 Expected employee contributions			-3,647,310
4 Employer normal cost: **(1) + (2) + (3)**			$1,761,779
5 Actuarial accrued liability			245,907,614
Retired participants and beneficiaries	$124,466,396		
Active participants	118,886,212		
Inactive participants	2,555,006		
6 Actuarial value of assets			107,767,058
7 Unfunded actuarial accrued liability: **(5) – (6)**			138,140,556
8 Reallocated unfunded actuarial accrued liability			1,773,843
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$139,914,399
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$1,821,992	4.85%
2 Projected unfunded actuarial accrued liability		144,931,328	
3 Payment on projected unfunded actuarial accrued liability		9,048,595	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$10,870,587	28.97%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		10,675,811	28.45%
7 Projected payroll		37,529,422	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$1,889,477	$1,959,437
2 Payment on projected unfunded actuarial accrued liability		10,076,910	10,806,903
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$11,966,387	$12,766,340
5 Total Actuarially Determined Contribution, payable on July 1		11,757,449	12,543,435

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Carlisle			1100
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 3 beneficiaries in pay status)			45
2 Participants active during the year ended December 31, 2019			108
3 Inactive participants entitled to a return of their employee contributions			29
4 Inactive participants with a vested right to a deferred or immediate benefit			4
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$887,291
2 Administrative expenses			42,199
3 Expected employee contributions			-583,135
4 Employer normal cost: **(1) + (2) + (3)**			$346,355
5 Actuarial accrued liability			30,686,579
Retired participants and beneficiaries	$12,269,412		
Active participants	17,832,720		
Inactive participants	584,447		
6 Actuarial value of assets			19,251,825
7 Unfunded actuarial accrued liability: **(5) – (6)**			11,434,754
8 Reallocated unfunded actuarial accrued liability			221,356
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$11,656,110
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$358,192	5.86%
2 Projected unfunded actuarial accrued liability		12,074,065	
3 Payment on projected unfunded actuarial accrued liability		718,926	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$1,077,118	17.61%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		1,057,819	17.29%
7 Projected payroll		6,117,684	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$371,255	$384,790
2 Payment on projected unfunded actuarial accrued liability		842,036	903,035
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$1,213,291	$1,287,825
5 Total Actuarially Determined Contribution, payable on July 1		1,192,106	1,265,339

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Chelmsford			1200
The valuation was made with respect to the following data supplied to us:			
1	Retired participants as of the valuation date (including 46 beneficiaries in pay status)		436
2	Participants active during the year ended December 31, 2019		566
3	Inactive participants entitled to a return of their employee contributions		173
4	Inactive participants with a vested right to a deferred or immediate benefit		21
The actuarial factors as of January 1, 2020 are as follows:			
1	Normal cost		$4,244,815
2	Administrative expenses		201,883
3	Expected employee contributions		-2,834,243
4	Employer normal cost: **(1) + (2) + (3)**		$1,612,455
5	Actuarial accrued liability		192,401,185
	Retired participants and beneficiaries	$108,623,629	
	Active participants	80,391,706	
	Inactive participants	3,385,850	
6	Actuarial value of assets		77,617,659
7	Unfunded actuarial accrued liability: **(5) – (6)**		114,783,526
8	Reallocated unfunded actuarial accrued liability		1,387,877
9	Total unfunded actuarial accrued liability: **(7) + (8)**		$116,171,403

The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1	Projected employer normal cost	$1,667,564	5.64%
2	Projected unfunded actuarial accrued liability	120,336,976	
3	Payment on projected unfunded actuarial accrued liability	8,017,533	
4	Payment on 2010 ERI	0	
5	Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$9,685,097	32.74%
6	Total FY21 Actuarially Determined Contribution, payable on July 1	9,511,562	32.16%
7	Projected payroll	29,577,991	

The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1	Projected employer normal cost	$1,728,559	$1,791,767
2	Payment on projected unfunded actuarial accrued liability	8,330,179	8,933,635
3	Payment on 2010 ERI	0	0
4	Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$10,058,738	$10,725,402
5	Total Actuarially Determined Contribution, payable on July 1	9,883,109	10,538,132

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Dracut		1300
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 20 beneficiaries in pay status)		244
2 Participants active during the year ended December 31, 2019		332
3 Inactive participants entitled to a return of their employee contributions		62
4 Inactive participants with a vested right to a deferred or immediate benefit		10
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,716,874
2 Administrative expenses		129,214
3 Expected employee contributions		-1,706,095
4 Employer normal cost: **(1) + (2) + (3)**		$1,139,993
5 Actuarial accrued liability		124,724,081
Retired participants and beneficiaries	$72,216,986	
Active participants	50,936,584	
Inactive participants	1,570,511	
6 Actuarial value of assets		55,524,952
7 Unfunded actuarial accrued liability: **(5) – (6)**		69,199,129
8 Reallocated unfunded actuarial accrued liability		899,691
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$70,098,820
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,178,955	6.65%
2 Projected unfunded actuarial accrued liability	72,612,363	
3 Payment on projected unfunded actuarial accrued liability	4,653,194	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$5,832,149	32.88%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	5,727,650	32.29%
7 Projected payroll	17,736,189	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,221,622	$1,265,825
2 Payment on projected unfunded actuarial accrued liability	5,039,941	5,405,044
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$6,261,563	$6,670,869
5 Total Actuarially Determined Contribution, payable on July 1	6,152,234	6,554,393

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Dunstable			1400
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			10
2 Participants active during the year ended December 31, 2019			23
3 Inactive participants entitled to a return of their employee contributions			2
4 Inactive participants with a vested right to a deferred or immediate benefit			1
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$252,357
2 Administrative expenses			12,002
3 Expected employee contributions			-147,665
4 Employer normal cost: **(1) + (2) + (3)**			$116,694
5 Actuarial accrued liability			7,045,099
Retired participants and beneficiaries	$2,651,860		
Active participants	4,312,563		
Inactive participants	80,676		
6 Actuarial value of assets			3,684,975
7 Unfunded actuarial accrued liability: **(5) – (6)**			3,360,124
8 Reallocated unfunded actuarial accrued liability			50,819
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$3,410,943
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$120,682	7.89%
2 Projected unfunded actuarial accrued liability		3,533,250	
3 Payment on projected unfunded actuarial accrued liability		176,947	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$297,629	19.46%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		292,296	19.11%
7 Projected payroll		1,529,192	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$125,009	$129,489
2 Payment on projected unfunded actuarial accrued liability		248,839	266,866
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$373,848	$396,355
5 Total Actuarially Determined Contribution, payable on July 1		367,320	389,434

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Groton		1500
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 4 beneficiaries in pay status)		65
2 Participants active during the year ended December 31, 2019		110
3 Inactive participants entitled to a return of their employee contributions		16
4 Inactive participants with a vested right to a deferred or immediate benefit		4
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$1,281,439
2 Administrative expenses		60,945
3 Expected employee contributions		-837,852
4 Employer normal cost: **(1) + (2) + (3)**		$504,532
5 Actuarial accrued liability		50,711,162
Retired participants and beneficiaries	$25,899,069	
Active participants	23,694,540	
Inactive participants	1,117,553	
6 Actuarial value of assets		24,961,763
7 Unfunded actuarial accrued liability: **(5) – (6)**		25,749,399
8 Reallocated unfunded actuarial accrued liability		365,803
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$26,115,202
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$521,775	6.18%
2 Projected unfunded actuarial accrued liability	27,051,618	
3 Payment on projected unfunded actuarial accrued liability	1,606,650	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,128,425	25.22%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,090,289	24.77%
7 Projected payroll	8,439,358	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$540,786	$560,484
2 Payment on projected unfunded actuarial accrued liability	1,886,857	2,023,544
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$2,427,643	$2,584,028
5 Total Actuarially Determined Contribution, payable on July 1	2,385,255	2,538,910

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Holliston		1600
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 11 beneficiaries in pay status)		126
2 Participants active during the year ended December 31, 2019		276
3 Inactive participants entitled to a return of their employee contributions		177
4 Inactive participants with a vested right to a deferred or immediate benefit		19
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$1,654,806
2 Administrative expenses		78,702
3 Expected employee contributions		-1,139,184
4 Employer normal cost: **(1) + (2) + (3)**		$594,324
5 Actuarial accrued liability		66,569,619
Retired participants and beneficiaries	$30,493,943	
Active participants	33,498,905	
Inactive participants	2,576,771	
6 Actuarial value of assets		39,284,645
7 Unfunded actuarial accrued liability: **(5) – (6)**		27,284,974
8 Reallocated unfunded actuarial accrued liability		480,197
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$27,765,171

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$614,636	5.10%
2 Projected unfunded actuarial accrued liability	28,760,750	
3 Payment on projected unfunded actuarial accrued liability	1,814,482	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,429,118	20.15%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,385,594	19.79%
7 Projected payroll	12,052,189	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$637,262	$660,714
2 Payment on projected unfunded actuarial accrued liability	1,998,331	2,143,094
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$2,635,593	$2,803,808
5 Total Actuarially Determined Contribution, payable on July 1	2,589,575	2,754,852

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Hopkinton		1700
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 8 beneficiaries in pay status)		115
2 Participants active during the year ended December 31, 2019		312
3 Inactive participants entitled to a return of their employee contributions		97
4 Inactive participants with a vested right to a deferred or immediate benefit		15
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,450,275
2 Administrative expenses		116,535
3 Expected employee contributions		-1,668,882
4 Employer normal cost: **(1) + (2) + (3)**		$897,928
5 Actuarial accrued liability		77,788,522
Retired participants and beneficiaries	$34,619,089	
Active participants	40,750,677	
Inactive participants	2,418,756	
6 Actuarial value of assets		50,770,346
7 Unfunded actuarial accrued liability: **(5) – (6)**		27,018,176
8 Reallocated unfunded actuarial accrued liability		561,124
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$27,579,300
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$928,617	5.37%
2 Projected unfunded actuarial accrued liability	28,568,215	
3 Payment on projected unfunded actuarial accrued liability	1,603,586	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,532,203	14.66%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,486,832	14.39%
7 Projected payroll	17,276,847	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$962,721	$998,068
2 Payment on projected unfunded actuarial accrued liability	1,999,418	2,144,260
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$2,962,139	$3,142,328
5 Total Actuarially Determined Contribution, payable on July 1	2,910,419	3,087,462

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Hudson		1800
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 23 beneficiaries in pay status)		228
2 Participants active during the year ended December 31, 2019		434
3 Inactive participants entitled to a return of their employee contributions		195
4 Inactive participants with a vested right to a deferred or immediate benefit		12
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$3,359,227
2 Administrative expenses		159,765
3 Expected employee contributions		-2,207,398
4 Employer normal cost: **(1) + (2) + (3)**		$1,311,594
5 Actuarial accrued liability		138,365,289
Retired participants and beneficiaries	$74,198,194	
Active participants	61,671,195	
Inactive participants	2,495,900	
6 Actuarial value of assets		68,329,943
7 Unfunded actuarial accrued liability: **(5) – (6)**		70,035,346
8 Reallocated unfunded actuarial accrued liability		998,092
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$71,033,438
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,356,421	5.91%
2 Projected unfunded actuarial accrued liability	73,580,493	
3 Payment on projected unfunded actuarial accrued liability	4,960,949	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$6,317,370	27.51%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	6,204,177	27.02%
7 Projected payroll	22,962,566	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,405,885	$1,457,140
2 Payment on projected unfunded actuarial accrued liability	5,089,254	5,457,931
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$6,495,139	$6,915,071
5 Total Actuarially Determined Contribution, payable on July 1	6,381,731	6,794,331

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Lincoln		1900
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 11 beneficiaries in pay status)		114
2 Participants active during the year ended December 31, 2019		198
3 Inactive participants entitled to a return of their employee contributions		88
4 Inactive participants with a vested right to a deferred or immediate benefit		10
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$1,553,264
2 Administrative expenses		73,873
3 Expected employee contributions		-1,085,477
4 Employer normal cost: **(1) + (2) + (3)**		$541,660
5 Actuarial accrued liability		59,499,402
Retired participants and beneficiaries	$29,861,088	
Active participants	28,218,802	
Inactive participants	1,419,512	
6 Actuarial value of assets		31,360,230
7 Unfunded actuarial accrued liability: **(5) – (6)**		28,139,172
8 Reallocated unfunded actuarial accrued liability		429,196
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$28,568,368
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$560,172	5.01%
2 Projected unfunded actuarial accrued liability	29,592,748	
3 Payment on projected unfunded actuarial accrued liability	1,918,244	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,478,416	22.17%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,434,008	21.77%
7 Projected payroll	11,179,768	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$580,866	$602,317
2 Payment on projected unfunded actuarial accrued liability	2,052,408	2,201,088
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$2,633,274	$2,803,405
5 Total Actuarially Determined Contribution, payable on July 1	2,587,296	2,754,456

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Littleton		2000
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 10 beneficiaries in pay status)		114
2 Participants active during the year ended December 31, 2019		244
3 Inactive participants entitled to a return of their employee contributions		88
4 Inactive participants with a vested right to a deferred or immediate benefit		8
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,014,387
2 Administrative expenses		95,804
3 Expected employee contributions		-1,359,836
4 Employer normal cost: **(1) + (2) + (3)**		$750,355
5 Actuarial accrued liability		69,553,263
Retired participants and beneficiaries	$35,936,884	
Active participants	31,583,478	
Inactive participants	2,032,901	
6 Actuarial value of assets		42,781,480
7 Unfunded actuarial accrued liability: **(5) – (6)**		26,771,783
8 Reallocated unfunded actuarial accrued liability		501,719
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$27,273,502

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$776,000	5.57%
2 Projected unfunded actuarial accrued liability	28,251,452	
3 Payment on projected unfunded actuarial accrued liability	1,622,143	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,398,143	17.21%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,355,174	16.90%
7 Projected payroll	13,934,456	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$804,446	$833,927
2 Payment on projected unfunded actuarial accrued liability	1,974,604	2,117,649
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$2,779,050	$2,951,576
5 Total Actuarially Determined Contribution, payable on July 1	2,730,527	2,900,040

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of North Reading		2100
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 24 beneficiaries in pay status)		184
2 Participants active during the year ended December 31, 2019		250
3 Inactive participants entitled to a return of their employee contributions		50
4 Inactive participants with a vested right to a deferred or immediate benefit		10
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,068,766
2 Administrative expenses		98,390
3 Expected employee contributions		-1,402,564
4 Employer normal cost: **(1) + (2) + (3)**		$764,592
5 Actuarial accrued liability		98,066,263
Retired participants and beneficiaries	$51,576,289	
Active participants	44,757,897	
Inactive participants	1,732,077	
6 Actuarial value of assets		45,555,904
7 Unfunded actuarial accrued liability: **(5) – (6)**		52,510,359
8 Reallocated unfunded actuarial accrued liability		707,396
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$53,217,755
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$790,724	5.42%
2 Projected unfunded actuarial accrued liability	55,125,991	
3 Payment on projected unfunded actuarial accrued liability	3,691,543	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$4,482,267	30.75%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	4,401,955	30.19%
7 Projected payroll	14,578,800	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$819,736	$849,803
2 Payment on projected unfunded actuarial accrued liability	3,814,665	4,091,008
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$4,634,401	$4,940,811
5 Total Actuarially Determined Contribution, payable on July 1	4,553,483	4,854,543

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Pepperell		2200
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 5 beneficiaries in pay status)		62
2 Participants active during the year ended December 31, 2019		74
3 Inactive participants entitled to a return of their employee contributions		13
4 Inactive participants with a vested right to a deferred or immediate benefit		5
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$798,882
2 Administrative expenses		37,995
3 Expected employee contributions		-506,353
4 Employer normal cost: **(1) + (2) + (3)**		$330,524
5 Actuarial accrued liability		35,167,997
Retired participants and beneficiaries	$19,961,176	
Active participants	14,086,155	
Inactive participants	1,120,666	
6 Actuarial value of assets		16,718,619
7 Unfunded actuarial accrued liability: **(5) – (6)**		18,449,378
8 Reallocated unfunded actuarial accrued liability		253,683
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$18,703,061
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$341,820	6.64%
2 Projected unfunded actuarial accrued liability	19,373,699	
3 Payment on projected unfunded actuarial accrued liability	1,216,400	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,558,220	30.28%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	1,530,300	29.74%
7 Projected payroll	5,145,895	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$354,209	$367,044
2 Payment on projected unfunded actuarial accrued liability	1,346,534	1,444,080
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,700,743	$1,811,124
5 Total Actuarially Determined Contribution, payable on July 1	1,671,047	1,779,501

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Sherborn		2300
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)		44
2 Participants active during the year ended December 31, 2019		82
3 Inactive participants entitled to a return of their employee contributions		35
4 Inactive participants with a vested right to a deferred or immediate benefit		9
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$689,015
2 Administrative expenses		32,769
3 Expected employee contributions		-444,649
4 Employer normal cost: **(1) + (2) + (3)**		$277,135
5 Actuarial accrued liability		23,896,655
Retired participants and beneficiaries	$11,809,297	
Active participants	10,892,606	
Inactive participants	1,194,752	
6 Actuarial value of assets		13,266,347
7 Unfunded actuarial accrued liability: **(5) – (6)**		10,630,308
8 Reallocated unfunded actuarial accrued liability		172,377
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$10,802,685
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$286,607	6.17%
2 Projected unfunded actuarial accrued liability	11,190,038	
3 Payment on projected unfunded actuarial accrued liability	820,712	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,107,319	23.84%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	1,087,478	23.41%
7 Projected payroll	4,645,573	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$297,025	$307,819
2 Payment on projected unfunded actuarial accrued liability	769,146	824,865
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,066,171	$1,132,684
5 Total Actuarially Determined Contribution, payable on July 1	1,047,555	1,112,907

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Shirley		2400
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 8 beneficiaries in pay status)		44
2 Participants active during the year ended December 31, 2019		34
3 Inactive participants entitled to a return of their employee contributions		23
4 Inactive participants with a vested right to a deferred or immediate benefit		4
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$331,040
2 Administrative expenses		15,744
3 Expected employee contributions		-207,738
4 Employer normal cost: **(1) + (2) + (3)**		$139,046
5 Actuarial accrued liability		16,994,636
Retired participants and beneficiaries	$12,211,363	
Active participants	3,937,722	
Inactive participants	845,551	
6 Actuarial value of assets		7,624,016
7 Unfunded actuarial accrued liability: **(5) – (6)**		9,370,620
8 Reallocated unfunded actuarial accrued liability		122,590
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$9,493,210
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$143,798	6.77%
2 Projected unfunded actuarial accrued liability	9,833,609	
3 Payment on projected unfunded actuarial accrued liability	690,108	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$833,906	39.23%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	818,964	38.53%
7 Projected payroll	2,125,563	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$149,002	$154,393
2 Payment on projected unfunded actuarial accrued liability	678,177	727,305
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$827,179	$881,698
5 Total Actuarially Determined Contribution, payable on July 1	812,736	866,303

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Stow		2500
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 4 beneficiaries in pay status)		43
2 Participants active during the year ended December 31, 2019		57
3 Inactive participants entitled to a return of their employee contributions		5
4 Inactive participants with a vested right to a deferred or immediate benefit		2
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$546,327
2 Administrative expenses		25,983
3 Expected employee contributions		-365,050
4 Employer normal cost: **(1) + (2) + (3)**		$207,260
5 Actuarial accrued liability		23,552,661
Retired participants and beneficiaries	$12,630,836	
Active participants	10,658,637	
Inactive participants	263,188	
6 Actuarial value of assets		11,536,523
7 Unfunded actuarial accrued liability: **(5) – (6)**		12,016,138
8 Reallocated unfunded actuarial accrued liability		169,896
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$12,186,034
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$214,344	5.72%
2 Projected unfunded actuarial accrued liability	12,622,990	
3 Payment on projected unfunded actuarial accrued liability	829,294	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,043,638	27.84%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	1,024,938	27.34%
7 Projected payroll	3,748,689	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$222,185	$230,311
2 Payment on projected unfunded actuarial accrued liability	874,664	938,027
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,096,849	$1,168,338
5 Total Actuarially Determined Contribution, payable on July 1	1,077,698	1,147,938

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Sudbury		2600
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 20 beneficiaries in pay status)		214
2 Participants active during the year ended December 31, 2019		307
3 Inactive participants entitled to a return of their employee contributions		96
4 Inactive participants with a vested right to a deferred or immediate benefit		16
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,665,101
2 Administrative expenses		126,752
3 Expected employee contributions		-1,825,066
4 Employer normal cost: **(1) + (2) + (3)**		$966,787
5 Actuarial accrued liability		116,717,753
Retired participants and beneficiaries	$62,285,174	
Active participants	51,658,102	
Inactive participants	2,774,477	
6 Actuarial value of assets		52,227,292
7 Unfunded actuarial accrued liability: **(5) – (6)**		64,490,461
8 Reallocated unfunded actuarial accrued liability		841,938
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$65,332,399
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$999,829	5.28%
2 Projected unfunded actuarial accrued liability	67,675,032	
3 Payment on projected unfunded actuarial accrued liability	4,488,353	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$5,488,182	29.00%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	5,389,846	28.49%
7 Projected payroll	18,921,604	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,036,592	$1,074,695
2 Payment on projected unfunded actuarial accrued liability	4,686,216	5,025,695
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$5,722,808	$6,100,390
5 Total Actuarially Determined Contribution, payable on July 1	5,622,886	5,993,875

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Tewksbury			2700
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 30 beneficiaries in pay status)			315
2 Participants active during the year ended December 31, 2019			397
3 Inactive participants entitled to a return of their employee contributions			121
4 Inactive participants with a vested right to a deferred or immediate benefit			13
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$3,645,589
2 Administrative expenses			173,384
3 Expected employee contributions			-2,391,581
4 Employer normal cost: **(1) + (2) + (3)**			$1,427,392
5 Actuarial accrued liability			179,364,203
Retired participants and beneficiaries	$104,320,952		
Active participants	72,968,702		
Inactive participants	2,074,549		
6 Actuarial value of assets			71,767,395
7 Unfunded actuarial accrued liability: **(5) – (6)**			107,596,808
8 Reallocated unfunded actuarial accrued liability			1,293,835
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$108,890,643
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$1,476,176	5.99%
2 Projected unfunded actuarial accrued liability		112,795,149	
3 Payment on projected unfunded actuarial accrued liability		7,482,307	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$8,958,483	36.33%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		8,797,968	35.68%
7 Projected payroll		24,661,175	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$1,529,991	$1,585,754
2 Payment on projected unfunded actuarial accrued liability		7,810,489	8,376,297
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$9,340,480	$9,962,051
5 Total Actuarially Determined Contribution, payable on July 1		9,177,392	9,788,110

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Townsend		2800
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 4 beneficiaries in pay status)		36
2 Participants active during the year ended December 31, 2019		65
3 Inactive participants entitled to a return of their employee contributions		10
4 Inactive participants with a vested right to a deferred or immediate benefit		3
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$623,694
2 Administrative expenses		29,663
3 Expected employee contributions		-365,769
4 Employer normal cost: **(1) + (2) + (3)**		$287,588
5 Actuarial accrued liability		21,302,131
Retired participants and beneficiaries	$12,575,321	
Active participants	7,940,784	
Inactive participants	786,026	
6 Actuarial value of assets		12,474,680
7 Unfunded actuarial accrued liability: **(5) – (6)**		8,827,451
8 Reallocated unfunded actuarial accrued liability		153,662
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$8,981,113
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$297,417	7.87%
2 Projected unfunded actuarial accrued liability	9,303,150	
3 Payment on projected unfunded actuarial accrued liability	630,372	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$927,789	24.54%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	911,165	24.10%
7 Projected payroll	3,781,228	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$308,082	$319,128
2 Payment on projected unfunded actuarial accrued liability	643,232	689,829
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$951,314	$1,008,957
5 Total Actuarially Determined Contribution, payable on July 1	934,704	991,340

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Tyngsborough		2900
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 13 beneficiaries in pay status)		93
2 Participants active during the year ended December 31, 2019		177
3 Inactive participants entitled to a return of their employee contributions		50
4 Inactive participants with a vested right to a deferred or immediate benefit		8
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$1,427,065
2 Administrative expenses		67,871
3 Expected employee contributions		-889,434
4 Employer normal cost: **(1) + (2) + (3)**		$605,502
5 Actuarial accrued liability		51,964,352
Retired participants and beneficiaries	$27,951,331	
Active participants	23,094,328	
Inactive participants	918,693	
6 Actuarial value of assets		26,650,448
7 Unfunded actuarial accrued liability: **(5) – (6)**		25,313,904
8 Reallocated unfunded actuarial accrued liability		374,842
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$25,688,746
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$626,196	6.78%
2 Projected unfunded actuarial accrued liability	26,609,871	
3 Payment on projected unfunded actuarial accrued liability	1,565,790	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,191,986	23.73%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,152,711	23.30%
7 Projected payroll	9,237,326	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$648,833	$672,284
2 Payment on projected unfunded actuarial accrued liability	1,857,109	1,991,642
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$2,505,942	$2,663,926
5 Total Actuarially Determined Contribution, payable on July 1	2,462,187	2,617,413

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Wayland		3000
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 20 beneficiaries in pay status)		250
2 Participants active during the year ended December 31, 2019		398
3 Inactive participants entitled to a return of their employee contributions		168
4 Inactive participants with a vested right to a deferred or immediate benefit		21
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,954,335
2 Administrative expenses		140,508
3 Expected employee contributions		-2,046,025
4 Employer normal cost: **(1) + (2) + (3)**		$1,048,818
5 Actuarial accrued liability		119,792,241
Retired participants and beneficiaries	$68,370,827	
Active participants	48,096,789	
Inactive participants	3,324,625	
6 Actuarial value of assets		59,996,379
7 Unfunded actuarial accrued liability: **(5) – (6)**		59,795,862
8 Reallocated unfunded actuarial accrued liability		864,116
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$60,659,978

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,084,664	5.11%
2 Projected unfunded actuarial accrued liability	62,835,071	
3 Payment on projected unfunded actuarial accrued liability	4,192,121	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$5,276,785	24.86%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	5,182,237	24.41%
7 Projected payroll	21,228,731	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,124,647	$1,166,091
2 Payment on projected unfunded actuarial accrued liability	4,349,266	4,664,336
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$5,473,913	$5,830,427
5 Total Actuarially Determined Contribution, payable on July 1	5,378,336	5,728,625

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Westford		3100
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 11 beneficiaries in pay status)		239
2 Participants active during the year ended December 31, 2019		543
3 Inactive participants entitled to a return of their employee contributions		180
4 Inactive participants with a vested right to a deferred or immediate benefit		18
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$3,902,123
2 Administrative expenses		185,585
3 Expected employee contributions		-2,636,354
4 Employer normal cost: **(1) + (2) + (3)**		$1,451,354
5 Actuarial accrued liability		144,372,799
Retired participants and beneficiaries	$64,873,095	
Active participants	76,310,063	
Inactive participants	3,189,641	
6 Actuarial value of assets		83,635,201
7 Unfunded actuarial accrued liability: **(5) – (6)**		60,737,598
8 Reallocated unfunded actuarial accrued liability		1,041,426
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$61,779,024
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,500,957	5.47%
2 Projected unfunded actuarial accrued liability	63,994,243	
3 Payment on projected unfunded actuarial accrued liability	4,012,338	
4 Payment on 2010 ERI	60,290	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$5,573,585	20.30%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	5,473,719	19.94%
7 Projected payroll	27,452,504	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,555,988	$1,613,021
2 Payment on projected unfunded actuarial accrued liability	4,439,737	4,761,360
3 Payment on 2010 ERI	60,291	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$6,056,016	$6,374,381
5 Total Actuarially Determined Contribution, payable on July 1	5,950,276	6,263,082

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Weston		3200
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 22 beneficiaries in pay status)		246
2 Participants active during the year ended December 31, 2019		380
3 Inactive participants entitled to a return of their employee contributions		174
4 Inactive participants with a vested right to a deferred or immediate benefit		18
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,946,831
2 Administrative expenses		140,151
3 Expected employee contributions		-2,106,268
4 Employer normal cost: **(1) + (2) + (3)**		$980,714
5 Actuarial accrued liability		128,903,636
Retired participants and beneficiaries	$66,150,912	
Active participants	58,837,313	
Inactive participants	3,915,411	
6 Actuarial value of assets		60,794,264
7 Unfunded actuarial accrued liability: **(5) – (6)**		68,109,372
8 Reallocated unfunded actuarial accrued liability		929,840
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$69,039,212
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,014,232	4.66%
2 Projected unfunded actuarial accrued liability	71,514,760	
3 Payment on projected unfunded actuarial accrued liability	4,757,842	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$5,772,074	26.49%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	5,668,652	26.02%
7 Projected payroll	21,787,828	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,051,914	$1,090,982
2 Payment on projected unfunded actuarial accrued liability	4,951,022	5,309,684
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$6,002,936	$6,400,666
5 Total Actuarially Determined Contribution, payable on July 1	5,898,122	6,288,908

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Town of Wilmington		3300
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 38 beneficiaries in pay status)		278
2 Participants active during the year ended December 31, 2019		417
3 Inactive participants entitled to a return of their employee contributions		119
4 Inactive participants with a vested right to a deferred or immediate benefit		13
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$3,415,288
2 Administrative expenses		162,431
3 Expected employee contributions		-2,411,422
4 Employer normal cost: **(1) + (2) + (3)**		$1,166,297
5 Actuarial accrued liability		168,966,637
Retired participants and beneficiaries	$91,328,584	
Active participants	75,473,855	
Inactive participants	2,164,198	
6 Actuarial value of assets		76,816,589
7 Unfunded actuarial accrued liability: **(5) – (6)**		92,150,048
8 Reallocated unfunded actuarial accrued liability		1,218,833
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$93,368,881
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$1,206,158	4.83%
2 Projected unfunded actuarial accrued liability	96,716,821	
3 Payment on projected unfunded actuarial accrued liability	6,526,257	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$7,732,415	30.98%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	7,593,868	30.43%
7 Projected payroll	24,956,279	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$1,250,828	$1,297,136
2 Payment on projected unfunded actuarial accrued liability	6,689,104	7,173,676
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$7,939,932	$8,470,812
5 Total Actuarially Determined Contribution, payable on July 1	7,801,298	8,322,908

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Acton-Boxborough RSD		3400
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 5 beneficiaries in pay status)		136
2 Participants active during the year ended December 31, 2019		366
3 Inactive participants entitled to a return of their employee contributions		79
4 Inactive participants with a vested right to a deferred or immediate benefit		13
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$2,176,737
2 Administrative expenses		103,525
3 Expected employee contributions		-1,479,732
4 Employer normal cost: **(1) + (2) + (3)**		$800,530
5 Actuarial accrued liability		64,400,223
Retired participants and beneficiaries	$27,477,528	
Active participants	35,025,413	
Inactive participants	1,897,282	
6 Actuarial value of assets		32,694,890
7 Unfunded actuarial accrued liability: **(5) – (6)**		31,705,333
8 Reallocated unfunded actuarial accrued liability		464,548
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$32,169,881
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$827,890	5.27%
2 Projected unfunded actuarial accrued liability	33,323,401	
3 Payment on projected unfunded actuarial accrued liability	2,017,439	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$2,845,329	18.10%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	2,794,347	17.78%
7 Projected payroll	15,717,451	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$858,283	$889,782
2 Payment on projected unfunded actuarial accrued liability	2,321,528	2,489,704
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$3,179,811	$3,379,486
5 Total Actuarially Determined Contribution, payable on July 1	3,124,290	3,320,479

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Acton Water Supply			3500
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			8
2 Participants active during the year ended December 31, 2019			16
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			2
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$119,094
2 Administrative expenses			5,664
3 Expected employee contributions			-127,175
4 Employer normal cost: **(1) + (2) + (3)**			-$2,417
5 Actuarial accrued liability			8,083,965
Retired participants and beneficiaries	$2,764,196		
Active participants	5,065,127		
Inactive participants	254,642		
6 Actuarial value of assets			4,299,020
7 Unfunded actuarial accrued liability: **(5) – (6)**			3,784,945
8 Reallocated unfunded actuarial accrued liability			58,313
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$3,843,258
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		-$2,500	-0.19%
2 Projected unfunded actuarial accrued liability		3,981,066	
3 Payment on projected unfunded actuarial accrued liability		264,159	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$261,659	20.18%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		256,971	19.82%
7 Projected payroll		1,296,434	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		-$2,390	-$2,271
2 Payment on projected unfunded actuarial accrued liability		275,663	295,633
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$273,273	$293,362
5 Total Actuarially Determined Contribution, payable on July 1		268,502	288,240

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Bedford Housing Authority			3600	
The valuation was made with respect to the following data supplied to us:				
1	Retired participants as of the valuation date (including 1 beneficiary in pay status)			2
2	Participants active during the year ended December 31, 2019			3
3	Inactive participants entitled to a return of their employee contributions			0
4	Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:				
1	Normal cost			$20,939
2	Administrative expenses			996
3	Expected employee contributions			-17,513
4	Employer normal cost: **(1) + (2) + (3)**			$4,422
5	Actuarial accrued liability			739,307
	Retired participants and beneficiaries	$237,337		
	Active participants	501,970		
	Inactive participants	0		
6	Actuarial value of assets			401,573
7	Unfunded actuarial accrued liability: **(5) – (6)**			337,734
8	Reallocated unfunded actuarial accrued liability			5,333
9	Total unfunded actuarial accrued liability: **(7) + (8)**			$343,067
The actuarial factors projected to FY21 are as follows:			Amount	% of Payroll
1	Projected employer normal cost		$4,573	2.56%
2	Projected unfunded actuarial accrued liability		355,368	
3	Payment on projected unfunded actuarial accrued liability		23,396	
4	Payment on 2010 ERI		0	
5	Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$27,969	15.68%
6	Total FY21 Actuarially Determined Contribution, payable on July 1		27,468	15.40%
7	Projected payroll		178,405	
The actuarial factors projected to FY22 and FY23 are as follows:			FY22	FY23
1	Projected employer normal cost		$4,755	$4,945
2	Payment on projected unfunded actuarial accrued liability		24,620	26,404
3	Payment on 2010 ERI		0	0
4	Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$29,375	$31,349
5	Total Actuarially Determined Contribution, payable on July 1		28,862	30,802

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Billerica Housing Authority			3700
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			5
2 Participants active during the year ended December 31, 2019			6
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$48,434
2 Administrative expenses			2,304
3 Expected employee contributions			-41,367
4 Employer normal cost: **(1) + (2) + (3)**			$9,371
5 Actuarial accrued liability			2,695,861
Retired participants and beneficiaries	$1,571,694		
Active participants	1,124,167		
Inactive participants	0		
6 Actuarial value of assets			1,048,322
7 Unfunded actuarial accrued liability: **(5) – (6)**			1,647,539
8 Reallocated unfunded actuarial accrued liability			19,446
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$1,666,985
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$9,691	2.30%
2 Projected unfunded actuarial accrued liability		1,726,758	
3 Payment on projected unfunded actuarial accrued liability		105,762	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$115,453	27.45%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		113,384	26.96%
7 Projected payroll		420,604	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$10,084	$10,492
2 Payment on projected unfunded actuarial accrued liability		120,208	128,917
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$130,292	$139,409
5 Total Actuarially Determined Contribution, payable on July 1		128,017	136,975

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Chelmsford Housing Authority			3800
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			4
2 Participants active during the year ended December 31, 2019			36
3 Inactive participants entitled to a return of their employee contributions			6
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$334,729
2 Administrative expenses			15,920
3 Expected employee contributions			-276,403
4 Employer normal cost: **(1) + (2) + (3)**			$74,246
5 Actuarial accrued liability			7,081,438
Retired participants and beneficiaries	$1,337,066		
Active participants	5,700,576		
Inactive participants	43,796		
6 Actuarial value of assets			4,716,900
7 Unfunded actuarial accrued liability: **(5) – (6)**			2,364,538
8 Reallocated unfunded actuarial accrued liability			51,082
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$2,415,620
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$76,784	2.77%
2 Projected unfunded actuarial accrued liability		2,502,237	
3 Payment on projected unfunded actuarial accrued liability		164,352	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$241,136	8.69%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		236,815	8.54%
7 Projected payroll		2,773,854	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$79,815	$82,963
2 Payment on projected unfunded actuarial accrued liability		173,386	185,947
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$253,201	$268,910
5 Total Actuarially Determined Contribution, payable on July 1		248,780	264,215

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Chelmsford Water District			3900
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			11
2 Participants active during the year ended December 31, 2019			21
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$160,460
2 Administrative expenses			7,631
3 Expected employee contributions			-142,803
4 Employer normal cost: **(1) + (2) + (3)**			$25,288
5 Actuarial accrued liability			8,647,978
Retired participants and beneficiaries	$3,426,475		
Active participants	5,221,503		
Inactive participants	0		
6 Actuarial value of assets			8,088,416
7 Unfunded actuarial accrued liability: **(5) – (6)**			559,562
8 Reallocated unfunded actuarial accrued liability			62,382
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$621,944
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$26,152	1.76%
2 Projected unfunded actuarial accrued liability		644,245	
3 Payment on projected unfunded actuarial accrued liability		42,929	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$69,081	4.64%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		67,843	4.56%
7 Projected payroll		1,487,223	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$27,259	$28,411
2 Payment on projected unfunded actuarial accrued liability		44,597	47,827
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$71,856	$76,238
5 Total Actuarially Determined Contribution, payable on July 1		70,601	74,907

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Dracut Housing Authority			4000
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			6
2 Participants active during the year ended December 31, 2019			6
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$45,694
2 Administrative expenses			2,173
3 Expected employee contributions			-42,303
4 Employer normal cost: **(1) + (2) + (3)**			$5,564
5 Actuarial accrued liability			3,456,242
Retired participants and beneficiaries	$1,841,072		
Active participants	1,615,170		
Inactive participants	0		
6 Actuarial value of assets			1,148,096
7 Unfunded actuarial accrued liability: **(5) – (6)**			2,308,146
8 Reallocated unfunded actuarial accrued liability			24,931
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$2,333,077
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$5,754	1.33%
2 Projected unfunded actuarial accrued liability		2,416,734	
3 Payment on projected unfunded actuarial accrued liability		159,463	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$165,217	38.08%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		162,257	37.40%
7 Projected payroll		433,847	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$6,014	$6,286
2 Payment on projected unfunded actuarial accrued liability		167,408	179,536
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$173,422	$185,822
5 Total Actuarially Determined Contribution, payable on July 1		170,394	182,577

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Dracut Water Supply		4100
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 2 beneficiaries in pay status)		6
2 Participants active during the year ended December 31, 2019		15
3 Inactive participants entitled to a return of their employee contributions		2
4 Inactive participants with a vested right to a deferred or immediate benefit		0
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$79,812
2 Administrative expenses		3,796
3 Expected employee contributions		-71,095
4 Employer normal cost: **(1) + (2) + (3)**		$12,513
5 Actuarial accrued liability		5,710,563
Retired participants and beneficiaries	$2,407,750	
Active participants	3,280,894	
Inactive participants	21,919	
6 Actuarial value of assets		2,348,373
7 Unfunded actuarial accrued liability: **(5) – (6)**		3,362,190
8 Reallocated unfunded actuarial accrued liability		41,193
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$3,403,383

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$12,941	1.73%
2 Projected unfunded actuarial accrued liability	3,525,419	
3 Payment on projected unfunded actuarial accrued liability	238,910	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$251,851	33.67%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	247,338	33.07%
7 Projected payroll	747,994	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$13,489	$14,060
2 Payment on projected unfunded actuarial accrued liability	243,750	261,407
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$257,239	$275,467
5 Total Actuarially Determined Contribution, payable on July 1	252,748	270,657

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for E. Chelmsford Water			4200
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			2
2 Participants active during the year ended December 31, 2019			3
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$28,113
2 Administrative expenses			1,337
3 Expected employee contributions			-21,553
4 Employer normal cost: **(1) + (2) + (3)**			$7,897
5 Actuarial accrued liability			1,095,382
Retired participants and beneficiaries	$275,969		
Active participants	819,413		
Inactive participants	0		
6 Actuarial value of assets			687,843
7 Unfunded actuarial accrued liability: **(5) – (6)**			407,539
8 Reallocated unfunded actuarial accrued liability			7,901
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$415,440
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$8,167	3.62%
2 Projected unfunded actuarial accrued liability		430,336	
3 Payment on projected unfunded actuarial accrued liability		28,489	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$36,656	16.24%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		35,999	15.95%
7 Projected payroll		225,717	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$8,477	$8,799
2 Payment on projected unfunded actuarial accrued liability		29,803	31,962
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$38,280	$40,761
5 Total Actuarially Determined Contribution, payable on July 1		37,612	40,049

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for E. Middlesex Mosq Control			4300
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			4
2 Participants active during the year ended December 31, 2019			6
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$39,461
2 Administrative expenses			1,877
3 Expected employee contributions			-37,302
4 Employer normal cost: **(1) + (2) + (3)**			$4,036
5 Actuarial accrued liability			2,410,191
Retired participants and beneficiaries	$1,672,399		
Active participants	737,792		
Inactive participants	0		
6 Actuarial value of assets			1,664,919
7 Unfunded actuarial accrued liability: **(5) – (6)**			745,272
8 Reallocated unfunded actuarial accrued liability			17,386
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$762,658
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$4,174	1.09%
2 Projected unfunded actuarial accrued liability		790,005	
3 Payment on projected unfunded actuarial accrued liability		48,271	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$52,445	13.64%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		51,505	13.40%
7 Projected payroll		384,426	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$4,373	$4,580
2 Payment on projected unfunded actuarial accrued liability		55,005	58,989
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$59,378	$63,569
5 Total Actuarially Determined Contribution, payable on July 1		58,341	62,459

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Greater Lowell RVTSD			4400
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 9 beneficiaries in pay status)			82
2 Participants active during the year ended December 31, 2019			88
3 Inactive participants entitled to a return of their employee contributions			21
4 Inactive participants with a vested right to a deferred or immediate benefit			6
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$531,721
2 Administrative expenses			25,289
3 Expected employee contributions			-430,331
4 Employer normal cost: **(1) + (2) + (3)**			$126,679
5 Actuarial accrued liability			31,615,211
Retired participants and beneficiaries	$18,131,902		
Active participants	12,285,366		
Inactive participants	1,197,943		
6 Actuarial value of assets			13,203,713
7 Unfunded actuarial accrued liability: **(5) – (6)**			18,411,498
8 Reallocated unfunded actuarial accrued liability			228,055
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$18,639,553
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$131,009	2.88%
2 Projected unfunded actuarial accrued liability		19,307,914	
3 Payment on projected unfunded actuarial accrued liability		1,199,928	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$1,330,937	29.29%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		1,307,090	28.77%
7 Projected payroll		4,543,859	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$136,118	$141,422
2 Payment on projected unfunded actuarial accrued liability		1,342,860	1,440,140
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$1,478,978	$1,581,562
5 Total Actuarially Determined Contribution, payable on July 1		1,453,154	1,553,947

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Groton-Dunstable RSD		4500
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 4 beneficiaries in pay status)		92
2 Participants active during the year ended December 31, 2019		119
3 Inactive participants entitled to a return of their employee contributions		62
4 Inactive participants with a vested right to a deferred or immediate benefit		5
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$564,543
2 Administrative expenses		26,850
3 Expected employee contributions		-381,416
4 Employer normal cost: **(1) + (2) + (3)**		$209,977
5 Actuarial accrued liability		29,084,400
Retired participants and beneficiaries	$18,595,656	
Active participants	9,692,591	
Inactive participants	796,153	
6 Actuarial value of assets		15,832,894
7 Unfunded actuarial accrued liability: **(5) – (6)**		13,251,506
8 Reallocated unfunded actuarial accrued liability		209,799
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$13,461,305
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$217,153	5.26%
2 Projected unfunded actuarial accrued liability	13,943,989	
3 Payment on projected unfunded actuarial accrued liability	880,363	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,097,516	26.58%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	1,077,851	26.10%
7 Projected payroll	4,129,632	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$225,115	$233,366
2 Payment on projected unfunded actuarial accrued liability	968,797	1,038,979
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,193,912	$1,272,345
5 Total Actuarially Determined Contribution, payable on July 1	1,173,066	1,250,129

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Hudson Housing Authority			4600
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			4
2 Participants active during the year ended December 31, 2019			6
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$44,397
2 Administrative expenses			2,112
3 Expected employee contributions			-37,242
4 Employer normal cost: **(1) + (2) + (3)**			$9,267
5 Actuarial accrued liability			1,640,547
Retired participants and beneficiaries	$1,097,259		
Active participants	540,707		
Inactive participants	2,581		
6 Actuarial value of assets			923,028
7 Unfunded actuarial accrued liability: **(5) – (6)**			717,519
8 Reallocated unfunded actuarial accrued liability			11,834
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$729,353
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$9,584	2.54%
2 Projected unfunded actuarial accrued liability		755,506	
3 Payment on projected unfunded actuarial accrued liability		90,283	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$99,867	26.47%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		98,078	26.00%
7 Projected payroll		377,273	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$9,966	$10,364
2 Payment on projected unfunded actuarial accrued liability		49,392	52,970
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$59,358	$63,334
5 Total Actuarially Determined Contribution, payable on July 1		58,322	62,228

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Lincoln Sudbury		4700
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 2 beneficiaries in pay status)		40
2 Participants active during the year ended December 31, 2019		60
3 Inactive participants entitled to a return of their employee contributions		26
4 Inactive participants with a vested right to a deferred or immediate benefit		4
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$370,487
2 Administrative expenses		17,620
3 Expected employee contributions		-290,754
4 Employer normal cost: **(1) + (2) + (3)**		$97,353
5 Actuarial accrued liability		17,305,778
Retired participants and beneficiaries	$7,576,027	
Active participants	8,710,716	
Inactive participants	1,019,035	
6 Actuarial value of assets		8,117,555
7 Unfunded actuarial accrued liability: **(5) – (6)**		9,188,223
8 Reallocated unfunded actuarial accrued liability		124,834
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$9,313,057

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$100,680	3.31%
2 Projected unfunded actuarial accrued liability	9,646,997	
3 Payment on projected unfunded actuarial accrued liability	668,969	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$769,649	25.29%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	755,859	24.83%
7 Projected payroll	3,043,810	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$104,546	$108,557
2 Payment on projected unfunded actuarial accrued liability	665,892	714,131
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$770,438	$822,688
5 Total Actuarially Determined Contribution, payable on July 1	756,986	808,324

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Nashoba Vally THSD			4900
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 2 beneficiaries in pay status)			16
2 Participants active during the year ended December 31, 2019			21
3 Inactive participants entitled to a return of their employee contributions			6
4 Inactive participants with a vested right to a deferred or immediate benefit			1
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$149,927
2 Administrative expenses			7,131
3 Expected employee contributions			-96,816
4 Employer normal cost: **(1) + (2) + (3)**			$60,242
5 Actuarial accrued liability			5,299,555
Retired participants and beneficiaries	$2,777,499		
Active participants	2,286,708		
Inactive participants	235,348		
6 Actuarial value of assets			1,586,335
7 Unfunded actuarial accrued liability: **(5) – (6)**			3,713,220
8 Reallocated unfunded actuarial accrued liability			38,228
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$3,751,448
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$62,301	6.17%
2 Projected unfunded actuarial accrued liability		3,885,964	
3 Payment on projected unfunded actuarial accrued liability		267,620	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$329,921	32.68%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		324,010	32.10%
7 Projected payroll		1,009,418	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$64,566	$66,913
2 Payment on projected unfunded actuarial accrued liability		268,367	287,808
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$332,933	$354,721
5 Total Actuarially Determined Contribution, payable on July 1		327,120	348,527

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for N. Chelmsford Water			5000
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			1
2 Participants active during the year ended December 31, 2019			8
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			1
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$56,594
2 Administrative expenses			2,692
3 Expected employee contributions			-61,863
4 Employer normal cost: **(1) + (2) + (3)**			-$2,577
5 Actuarial accrued liability			3,596,783
Retired participants and beneficiaries	$58,522		
Active participants	3,443,292		
Inactive participants	94,969		
6 Actuarial value of assets			2,473,196
7 Unfunded actuarial accrued liability: **(5) – (6)**			1,123,587
8 Reallocated unfunded actuarial accrued liability			25,945
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$1,149,532
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		-$2,665	-0.39%
2 Projected unfunded actuarial accrued liability		1,190,751	
3 Payment on projected unfunded actuarial accrued liability		76,323	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$73,658	10.83%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		72,338	10.64%
7 Projected payroll		680,145	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		-$2,661	-$2,654
2 Payment on projected unfunded actuarial accrued liability		82,647	88,635
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$79,986	$85,981
5 Total Actuarially Determined Contribution, payable on July 1		78,589	84,480

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for North Middlesex RSD		5100
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 7 beneficiaries in pay status)		90
2 Participants active during the year ended December 31, 2019		156
3 Inactive participants entitled to a return of their employee contributions		90
4 Inactive participants with a vested right to a deferred or immediate benefit		9
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$720,327
2 Administrative expenses		34,259
3 Expected employee contributions		-519,167
4 Employer normal cost: **(1) + (2) + (3)**		$235,419
5 Actuarial accrued liability		27,439,453
Retired participants and beneficiaries	$12,510,832	
Active participants	13,878,546	
Inactive participants	1,050,075	
6 Actuarial value of assets		13,893,270
7 Unfunded actuarial accrued liability: **(5) – (6)**		13,546,183
8 Reallocated unfunded actuarial accrued liability		197,933
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$13,744,116
The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$243,465	4.35%
2 Projected unfunded actuarial accrued liability	14,236,941	
3 Payment on projected unfunded actuarial accrued liability	900,958	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$1,144,423	20.43%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	1,123,918	20.06%
7 Projected payroll	5,601,805	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$252,531	$261,932
2 Payment on projected unfunded actuarial accrued liability	988,998	1,060,643
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$1,241,529	$1,322,575
5 Total Actuarially Determined Contribution, payable on July 1	1,219,851	1,299,482

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Shawsheen Valley RVS			5300
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 6 beneficiaries in pay status)			47
2 Participants active during the year ended December 31, 2019			57
3 Inactive participants entitled to a return of their employee contributions			24
4 Inactive participants with a vested right to a deferred or immediate benefit			2
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$333,734
2 Administrative expenses			15,872
3 Expected employee contributions			-265,817
4 Employer normal cost: **(1) + (2) + (3)**			$83,789
5 Actuarial accrued liability			16,138,990
Retired participants and beneficiaries	$8,507,206		
Active participants	6,444,100		
Inactive participants	1,187,684		
6 Actuarial value of assets			7,226,485
7 Unfunded actuarial accrued liability: **(5) – (6)**			8,912,505
8 Reallocated unfunded actuarial accrued liability			116,418
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$9,028,923
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$86,653	3.11%
2 Projected unfunded actuarial accrued liability		9,352,674	
3 Payment on projected unfunded actuarial accrued liability		632,526	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$719,179	25.82%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		706,293	25.36%
7 Projected payroll		2,785,434	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$90,003	$93,481
2 Payment on projected unfunded actuarial accrued liability		646,743	693,595
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$736,746	$787,076
5 Total Actuarially Determined Contribution, payable on July 1		723,882	773,333

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for South Middlesex RVTS		5400
The valuation was made with respect to the following data supplied to us:		
1 Retired participants as of the valuation date (including 4 beneficiaries in pay status)		42
2 Participants active during the year ended December 31, 2019		43
3 Inactive participants entitled to a return of their employee contributions		22
4 Inactive participants with a vested right to a deferred or immediate benefit		1
The actuarial factors as of January 1, 2020 are as follows:		
1 Normal cost		$275,310
2 Administrative expenses		13,094
3 Expected employee contributions		-216,465
4 Employer normal cost: **(1) + (2) + (3)**		$71,939
5 Actuarial accrued liability		14,119,182
Retired participants and beneficiaries	$7,901,855	
Active participants	5,967,602	
Inactive participants	249,725	
6 Actuarial value of assets		7,022,939
7 Unfunded actuarial accrued liability: **(5) – (6)**		7,096,243
8 Reallocated unfunded actuarial accrued liability		101,848
9 Total unfunded actuarial accrued liability: **(7) + (8)**		$7,198,091

The actuarial factors projected to FY21 are as follows:	Amount	% of Payroll
1 Projected employer normal cost	$74,398	3.24%
2 Projected unfunded actuarial accrued liability	7,456,194	
3 Payment on projected unfunded actuarial accrued liability	536,499	
4 Payment on 2010 ERI	0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**	$610,897	26.57%
6 Total FY21 Actuarially Determined Contribution, payable on July 1	599,951	26.10%
7 Projected payroll	2,298,936	

The actuarial factors projected to FY22 and FY23 are as follows:	FY22	FY23
1 Projected employer normal cost	$77,257	$80,223
2 Payment on projected unfunded actuarial accrued liability	513,255	550,436
3 Payment on 2010 ERI	0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$590,512	$630,659
5 Total Actuarially Determined Contribution, payable on July 1	580,201	619,647

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Sudbury Water District			5500
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			3
2 Participants active during the year ended December 31, 2019			10
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$87,996
2 Administrative expenses			4,185
3 Expected employee contributions			-103,387
4 Employer normal cost: **(1) + (2) + (3)**			-$11,206
5 Actuarial accrued liability			6,253,542
Retired participants and beneficiaries	$1,228,439		
Active participants	5,025,103		
Inactive participants	0		
6 Actuarial value of assets			3,627,568
7 Unfunded actuarial accrued liability: **(5) – (6)**			2,625,974
8 Reallocated unfunded actuarial accrued liability			45,110
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$2,671,084
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		-$11,589	-1.06%
2 Projected unfunded actuarial accrued liability		2,766,861	
3 Payment on projected unfunded actuarial accrued liability		156,346	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$144,757	13.27%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		142,163	13.03%
7 Projected payroll		1,091,196	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		-$11,825	-$12,063
2 Payment on projected unfunded actuarial accrued liability		193,570	207,593
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$181,745	$195,530
5 Total Actuarially Determined Contribution, payable on July 1		178,572	192,116

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Tewksbury Housing Authority			5600
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			6
2 Participants active during the year ended December 31, 2019			7
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			2
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$54,642
2 Administrative expenses			2,599
3 Expected employee contributions			-42,078
4 Employer normal cost: **(1) + (2) + (3)**			$15,163
5 Actuarial accrued liability			3,227,034
Retired participants and beneficiaries	$1,937,868		
Active participants	974,709		
Inactive participants	314,457		
6 Actuarial value of assets			1,492,879
7 Unfunded actuarial accrued liability: **(5) – (6)**			1,734,155
8 Reallocated unfunded actuarial accrued liability			23,278
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$1,757,433
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$15,681	3.67%
2 Projected unfunded actuarial accrued liability		1,820,450	
3 Payment on projected unfunded actuarial accrued liability		121,516	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$137,197	32.09%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		134,739	31.52%
7 Projected payroll		427,490	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$16,278	$16,898
2 Payment on projected unfunded actuarial accrued liability		126,002	135,130
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$142,280	$152,028
5 Total Actuarially Determined Contribution, payable on July 1		139,796	149,374

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Wayland Housing Authority			5700
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			4
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$36,251
2 Administrative expenses			1,724
3 Expected employee contributions			-30,623
4 Employer normal cost: **(1) + (2) + (3)**			$7,352
5 Actuarial accrued liability			1,874,874
Retired participants and beneficiaries	$201,203		
Active participants	1,673,121		
Inactive participants	550		
6 Actuarial value of assets			1,178,672
7 Unfunded actuarial accrued liability: **(5) – (6)**			696,202
8 Reallocated unfunded actuarial accrued liability			13,524
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$709,726
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$7,603	2.35%
2 Projected unfunded actuarial accrued liability		735,175	
3 Payment on projected unfunded actuarial accrued liability		48,506	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$56,109	17.38%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		55,104	17.07%
7 Projected payroll		322,874	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$7,908	$8,226
2 Payment on projected unfunded actuarial accrued liability		50,926	54,615
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$58,834	$62,841
5 Total Actuarially Determined Contribution, payable on July 1		57,807	61,744

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Hopkinton Housing Authority			5800
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			2
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$11,132
2 Administrative expenses			529
3 Expected employee contributions			-7,677
4 Employer normal cost: **(1) + (2) + (3)**			$3,984
5 Actuarial accrued liability			1,044,731
Retired participants and beneficiaries	$1,001,973		
Active participants	42,758		
Inactive participants	0		
6 Actuarial value of assets			503,054
7 Unfunded actuarial accrued liability: **(5) – (6)**			541,677
8 Reallocated unfunded actuarial accrued liability			7,536
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$549,213
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$4,120	5.02%
2 Projected unfunded actuarial accrued liability		568,906	
3 Payment on projected unfunded actuarial accrued liability		35,903	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$40,023	48.81%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		39,306	47.93%
7 Projected payroll		82,005	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$4,272	$4,429
2 Payment on projected unfunded actuarial accrued liability		39,527	42,391
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$43,799	$46,820
5 Total Actuarially Determined Contribution, payable on July 1		43,034	46,003

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Sudbury Housing Authority			6000
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			3
2 Participants active during the year ended December 31, 2019			2
3 Inactive participants entitled to a return of their employee contributions			2
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$17,466
2 Administrative expenses			831
3 Expected employee contributions			-10,555
4 Employer normal cost: **(1) + (2) + (3)**			$7,742
5 Actuarial accrued liability			886,116
Retired participants and beneficiaries	$742,609		
Active participants	126,221		
Inactive participants	17,286		
6 Actuarial value of assets			393,749
7 Unfunded actuarial accrued liability: **(5) – (6)**			492,367
8 Reallocated unfunded actuarial accrued liability			6,392
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$498,759
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$8,007	7.37%
2 Projected unfunded actuarial accrued liability		516,643	
3 Payment on projected unfunded actuarial accrued liability		35,932	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$43,939	40.47%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		43,152	39.74%
7 Projected payroll		108,584	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$8,295	$8,593
2 Payment on projected unfunded actuarial accrued liability		35,654	38,237
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$43,949	$46,830
5 Total Actuarially Determined Contribution, payable on July 1		43,182	46,012

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Wilmington Housing Authority			6100
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			4
2 Participants active during the year ended December 31, 2019			3
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$20,812
2 Administrative expenses			990
3 Expected employee contributions			-14,301
4 Employer normal cost: **(1) + (2) + (3)**			$7,501
5 Actuarial accrued liability			737,689
Retired participants and beneficiaries	$324,063		
Active participants	412,525		
Inactive participants	1,101		
6 Actuarial value of assets			352,594
7 Unfunded actuarial accrued liability: **(5) – (6)**			385,095
8 Reallocated unfunded actuarial accrued liability			5,321
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$390,416
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$7,757	5.24%
2 Projected unfunded actuarial accrued liability		404,415	
3 Payment on projected unfunded actuarial accrued liability		25,411	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$33,168	22.40%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		32,574	22.00%
7 Projected payroll		148,092	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$8,043	$8,339
2 Payment on projected unfunded actuarial accrued liability		28,107	30,143
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$36,150	$38,482
5 Total Actuarially Determined Contribution, payable on July 1		35,519	37,810

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Acton Housing Authority			6200
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 1 beneficiary in pay status)			6
2 Participants active during the year ended December 31, 2019			6
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$47,866
2 Administrative expenses			2,277
3 Expected employee contributions			-41,312
4 Employer normal cost: **(1) + (2) + (3)**			$8,831
5 Actuarial accrued liability			2,191,626
Retired participants and beneficiaries	$1,416,865		
Active participants	771,156		
Inactive participants	3,605		
6 Actuarial value of assets			1,265,254
7 Unfunded actuarial accrued liability: **(5) – (6)**			926,372
8 Reallocated unfunded actuarial accrued liability			15,809
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$942,181
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$9,133	2.15%
2 Projected unfunded actuarial accrued liability		975,965	
3 Payment on projected unfunded actuarial accrued liability		57,567	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$66,700	15.73%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		65,505	15.45%
7 Projected payroll		424,049	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$9,506	$9,895
2 Payment on projected unfunded actuarial accrued liability		68,103	73,036
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$77,609	$82,931
5 Total Actuarially Determined Contribution, payable on July 1		76,254	81,483

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Burlington Housing Authority			6300
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			3
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$27,099
2 Administrative expenses			1,289
3 Expected employee contributions			-21,200
4 Employer normal cost: **(1) + (2) + (3)**			$7,188
5 Actuarial accrued liability			1,290,195
Retired participants and beneficiaries	$630,564		
Active participants	659,631		
Inactive participants	0		
6 Actuarial value of assets			925,187
7 Unfunded actuarial accrued liability: **(5) – (6)**			365,008
8 Reallocated unfunded actuarial accrued liability			9,307
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$374,315
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$7,434	3.37%
2 Projected unfunded actuarial accrued liability		387,737	
3 Payment on projected unfunded actuarial accrued liability		7,177	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$14,611	6.62%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		14,349	6.51%
7 Projected payroll		220,559	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$7,719	$8,014
2 Payment on projected unfunded actuarial accrued liability		28,198	30,241
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$35,917	$38,255
5 Total Actuarially Determined Contribution, payable on July 1		35,290	37,587

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Ayer Housing Authority			6400
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			1
2 Participants active during the year ended December 31, 2019			2
3 Inactive participants entitled to a return of their employee contributions			2
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$14,828
2 Administrative expenses			705
3 Expected employee contributions			-12,178
4 Employer normal cost: **(1) + (2) + (3)**			$3,355
5 Actuarial accrued liability			1,180,762
Retired participants and beneficiaries	$701,130		
Active participants	474,648		
Inactive participants	4,984		
6 Actuarial value of assets			308,582
7 Unfunded actuarial accrued liability: **(5) – (6)**			872,180
8 Reallocated unfunded actuarial accrued liability			8,517
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$880,697
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$3,470	2.81%
2 Projected unfunded actuarial accrued liability		912,276	
3 Payment on projected unfunded actuarial accrued liability		59,779	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$63,249	51.18%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		62,116	50.26%
7 Projected payroll		123,583	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$3,606	$3,748
2 Payment on projected unfunded actuarial accrued liability		63,224	67,804
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$66,830	$71,552
5 Total Actuarially Determined Contribution, payable on July 1		65,663	70,303

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Holliston Housing Authority			6500
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			1
2 Participants active during the year ended December 31, 2019			2
3 Inactive participants entitled to a return of their employee contributions			2
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$14,106
2 Administrative expenses			671
3 Expected employee contributions			-8,227
4 Employer normal cost: **(1) + (2) + (3)**			$6,550
5 Actuarial accrued liability			416,700
Retired participants and beneficiaries	$118,182		
Active participants	296,622		
Inactive participants	1,896		
6 Actuarial value of assets			237,697
7 Unfunded actuarial accrued liability: **(5) – (6)**			179,003
8 Reallocated unfunded actuarial accrued liability			3,006
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$182,009
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$6,774	7.90%
2 Projected unfunded actuarial accrued liability		188,535	
3 Payment on projected unfunded actuarial accrued liability		9,296	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$16,070	18.75%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		15,782	18.42%
7 Projected payroll		85,700	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$7,017	$7,268
2 Payment on projected unfunded actuarial accrued liability		13,289	14,251
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$20,306	$21,519
5 Total Actuarially Determined Contribution, payable on July 1		19,951	21,143

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Littleton Housing Authority			6600
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			1
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$7,195
2 Administrative expenses			342
3 Expected employee contributions			-3,921
4 Employer normal cost: **(1) + (2) + (3)**			$3,616
5 Actuarial accrued liability			647,534
Retired participants and beneficiaries	$592,680		
Active participants	54,854		
Inactive participants	0		
6 Actuarial value of assets			35,651
7 Unfunded actuarial accrued liability: **(5) – (6)**			611,883
8 Reallocated unfunded actuarial accrued liability			4,671
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$616,554
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$3,740	8.96%
2 Projected unfunded actuarial accrued liability		638,662	
3 Payment on projected unfunded actuarial accrued liability		39,616	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$43,356	103.83%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		42,579	101.97%
7 Projected payroll		41,758	
The actuarial factors projected to FY22 and FY23 are as follows:	FY22		FY23
1 Projected employer normal cost	$3,873		$4,010
2 Payment on projected unfunded actuarial accrued liability	44,424		47,642
3 Payment on 2010 ERI	0		0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$48,297		$51,652
5 Total Actuarially Determined Contribution, payable on July 1	47,454		50,750

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Westford Housing Authority			6700
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			4
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$32,604
2 Administrative expenses			1,551
3 Expected employee contributions			-23,509
4 Employer normal cost: **(1) + (2) + (3)**			$10,646
5 Actuarial accrued liability			1,283,498
Retired participants and beneficiaries	$677,246		
Active participants	606,252		
Inactive participants	0		
6 Actuarial value of assets			703,528
7 Unfunded actuarial accrued liability: **(5) – (6)**			579,970
8 Reallocated unfunded actuarial accrued liability			9,258
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$589,228
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$11,010	4.61%
2 Projected unfunded actuarial accrued liability		610,356	
3 Payment on projected unfunded actuarial accrued liability		39,715	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$50,725	21.23%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		49,816	20.85%
7 Projected payroll		238,924	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$11,420	$11,845
2 Payment on projected unfunded actuarial accrued liability		42,108	45,158
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$53,528	$57,003
5 Total Actuarially Determined Contribution, payable on July 1		52,593	56,008

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Shirley Water District			6800
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 2 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			3
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$19,487
2 Administrative expenses			927
3 Expected employee contributions			-21,592
4 Employer normal cost: **(1) + (2) + (3)**			-$1,178
5 Actuarial accrued liability			1,485,408
Retired participants and beneficiaries	$384,591		
Active participants	1,100,817		
Inactive participants	0		
6 Actuarial value of assets			982,213
7 Unfunded actuarial accrued liability: **(5) – (6)**			503,195
8 Reallocated unfunded actuarial accrued liability			10,715
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$513,910
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		-$1,218	-0.53%
2 Projected unfunded actuarial accrued liability		532,337	
3 Payment on projected unfunded actuarial accrued liability		26,274	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$25,056	10.93%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		24,607	10.74%
7 Projected payroll		229,201	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		-$1,227	-$1,234
2 Payment on projected unfunded actuarial accrued liability		37,519	40,237
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$36,292	$39,003
5 Total Actuarially Determined Contribution, payable on July 1		35,658	38,322

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Tyngsboro Housing Authority			6900
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			3
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			1
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$25,978
2 Administrative expenses			1,236
3 Expected employee contributions			-18,027
4 Employer normal cost: **(1) + (2) + (3)**			$9,187
5 Actuarial accrued liability			798,694
Retired participants and beneficiaries	$403,190		
Active participants	292,419		
Inactive participants	103,085		
6 Actuarial value of assets			271,687
7 Unfunded actuarial accrued liability: **(5) – (6)**			527,007
8 Reallocated unfunded actuarial accrued liability			5,761
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$532,768
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$9,501	5.19%
2 Projected unfunded actuarial accrued liability		551,872	
3 Payment on projected unfunded actuarial accrued liability		35,877	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$45,378	24.78%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		44,565	24.33%
7 Projected payroll		183,152	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$9,851	$10,215
2 Payment on projected unfunded actuarial accrued liability		38,268	41,040
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$48,119	$51,255
5 Total Actuarially Determined Contribution, payable on July 1		47,279	50,360

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Pepperell Housing Authority			7000
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			1
2 Participants active during the year ended December 31, 2019			2
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$15,370
2 Administrative expenses			731
3 Expected employee contributions			-10,695
4 Employer normal cost: **(1) + (2) + (3)**			$5,406
5 Actuarial accrued liability			448,884
Retired participants and beneficiaries	$247,725		
Active participants	201,159		
Inactive participants	0		
6 Actuarial value of assets			196,501
7 Unfunded actuarial accrued liability: **(5) – (6)**			252,383
8 Reallocated unfunded actuarial accrued liability			3,238
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$255,621
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$5,591	5.09%
2 Projected unfunded actuarial accrued liability		264,787	
3 Payment on projected unfunded actuarial accrued liability		13,074	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$18,665	16.99%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		18,331	16.68%
7 Projected payroll		109,875	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$5,797	$6,011
2 Payment on projected unfunded actuarial accrued liability		18,662	20,014
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$24,459	$26,025
5 Total Actuarially Determined Contribution, payable on July 1		24,032	25,571

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Groton Housing Authority			7100	
The valuation was made with respect to the following data supplied to us:				
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)				0
2 Participants active during the year ended December 31, 2019				0
3 Inactive participants entitled to a return of their employee contributions				0
4 Inactive participants with a vested right to a deferred or immediate benefit				0
The actuarial factors as of January 1, 2020 are as follows:				
1 Normal cost				$0
2 Administrative expenses				0
3 Expected employee contributions				0
4 Employer normal cost: **(1) + (2) + (3)**				$0
5 Actuarial accrued liability				0
Retired participants and beneficiaries	$0			
Active participants	0			
Inactive participants	0			
6 Actuarial value of assets				0
7 Unfunded actuarial accrued liability: **(5) – (6)**				0
8 Reallocated unfunded actuarial accrued liability				0
9 Total unfunded actuarial accrued liability: **(7) + (8)**				$0
The actuarial factors projected to FY21 are as follows:		Amount		% of Payroll
1 Projected employer normal cost		$0		N/A
2 Projected unfunded actuarial accrued liability		0		
3 Payment on projected unfunded actuarial accrued liability		2,919		
4 Payment on 2010 ERI		0		
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$2,919		N/A
6 Total FY21 Actuarially Determined Contribution, payable on July 1		2,867		N/A
7 Projected payroll		0		
The actuarial factors projected to FY22 and FY23 are as follows:	FY22			FY23
1 Projected employer normal cost	$0			$0
2 Payment on projected unfunded actuarial accrued liability	0			0
3 Payment on 2010 ERI	0			0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**	$0			$0
5 Total Actuarially Determined Contribution, payable on July 1	0			0

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Tyngsboro Water District			7200
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2 Participants active during the year ended December 31, 2019			7
3 Inactive participants entitled to a return of their employee contributions			0
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$25,955
2 Administrative expenses			1,234
3 Expected employee contributions			-20,221
4 Employer normal cost: **(1) + (2) + (3)**			$6,968
5 Actuarial accrued liability			1,494,110
Retired participants and beneficiaries	$648,110		
Active participants	846,000		
Inactive participants	0		
6 Actuarial value of assets			993,602
7 Unfunded actuarial accrued liability: **(5) – (6)**			500,508
8 Reallocated unfunded actuarial accrued liability			10,778
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$511,286
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$7,206	3.36%
2 Projected unfunded actuarial accrued liability		529,619	
3 Payment on projected unfunded actuarial accrued liability		33,778	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$40,984	19.11%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		40,250	18.76%
7 Projected payroll		214,512	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$7,482	$7,768
2 Payment on projected unfunded actuarial accrued liability		36,772	39,436
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$44,254	$47,204
5 Total Actuarially Determined Contribution, payable on July 1		43,481	46,380

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for North Reading Housing Authority			7400	
The valuation was made with respect to the following data supplied to us:				
1	Retired participants as of the valuation date (including 0 beneficiaries in pay status)			2
2	Participants active during the year ended December 31, 2019			3
3	Inactive participants entitled to a return of their employee contributions			0
4	Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:				
1	Normal cost			$13,983
2	Administrative expenses			665
3	Expected employee contributions			-8,764
4	Employer normal cost: **(1) + (2) + (3)**			$5,884
5	Actuarial accrued liability			462,982
	Retired participants and beneficiaries	$173,038		
	Active participants	289,944		
	Inactive participants	0		
6	Actuarial value of assets			245,782
7	Unfunded actuarial accrued liability: **(5) – (6)**			217,200
8	Reallocated unfunded actuarial accrued liability			3,340
9	Total unfunded actuarial accrued liability: **(7) + (8)**			$220,540
The actuarial factors projected to FY21 are as follows:			Amount	% of Payroll
1	Projected employer normal cost		$6,085	6.33%
2	Projected unfunded actuarial accrued liability		228,448	
3	Payment on projected unfunded actuarial accrued liability		11,946	
4	Payment on 2010 ERI		0	
5	Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$18,031	18.75%
6	Total FY21 Actuarially Determined Contribution, payable on July 1		17,708	18.42%
7	Projected payroll		96,141	
The actuarial factors projected to FY22 and FY23 are as follows:			FY22	FY23
1	Projected employer normal cost		$6,305	$6,533
2	Payment on projected unfunded actuarial accrued liability		16,052	17,215
3	Payment on 2010 ERI		0	0
4	Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$22,357	$23,748
5	Total Actuarially Determined Contribution, payable on July 1		21,967	23,333

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for West Groton Water			7500
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			0
2 Participants active during the year ended December 31, 2019			2
3 Inactive participants entitled to a return of their employee contributions			1
4 Inactive participants with a vested right to a deferred or immediate benefit			0
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$10,703
2 Administrative expenses			509
3 Expected employee contributions			-12,126
4 Employer normal cost: **(1) + (2) + (3)**			-$914
5 Actuarial accrued liability			495,434
Retired participants and beneficiaries	$0		
Active participants	483,124		
Inactive participants	12,310		
6 Actuarial value of assets			447,036
7 Unfunded actuarial accrued liability: **(5) – (6)**			48,398
8 Reallocated unfunded actuarial accrued liability			3,574
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$51,972
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		-$945	-0.72%
2 Projected unfunded actuarial accrued liability		53,836	
3 Payment on projected unfunded actuarial accrued liability		3,732	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$2,787	2.11%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		2,737	2.07%
7 Projected payroll		131,907	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		-$959	-$972
2 Payment on projected unfunded actuarial accrued liability		3,716	3,985
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$2,757	$3,013
5 Total Actuarially Determined Contribution, payable on July 1		2,709	2,960

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 3: Unit Results

Summary of Actuarial Valuation Results for Ayer-Shirley RSD			7600
The valuation was made with respect to the following data supplied to us:			
1 Retired participants as of the valuation date (including 0 beneficiaries in pay status)			25
2 Participants active during the year ended December 31, 2019			110
3 Inactive participants entitled to a return of their employee contributions			53
4 Inactive participants with a vested right to a deferred or immediate benefit			9
The actuarial factors as of January 1, 2020 are as follows:			
1 Normal cost			$474,378
2 Administrative expenses			22,561
3 Expected employee contributions			-345,897
4 Employer normal cost: **(1) + (2) + (3)**			$151,042
5 Actuarial accrued liability			15,593,564
Retired participants and beneficiaries	$5,837,751		
Active participants	8,864,430		
Inactive participants	891,383		
6 Actuarial value of assets			10,670,110
7 Unfunded actuarial accrued liability: **(5) – (6)**			4,923,454
8 Reallocated unfunded actuarial accrued liability			112,483
9 Total unfunded actuarial accrued liability: **(7) + (8)**			$5,035,937
The actuarial factors projected to FY21 are as follows:		Amount	% of Payroll
1 Projected employer normal cost		$156,204	4.19%
2 Projected unfunded actuarial accrued liability		5,216,511	
3 Payment on projected unfunded actuarial accrued liability		351,000	
4 Payment on 2010 ERI		0	
5 Total FY21 Actuarially Determined Contribution: **(1) + (3) + (4)**		$507,204	13.61%
6 Total FY21 Actuarially Determined Contribution, payable on July 1		498,116	13.36%
7 Projected payroll		3,727,828	
The actuarial factors projected to FY22 and FY23 are as follows:		FY22	FY23
1 Projected employer normal cost		$162,041	$168,093
2 Payment on projected unfunded actuarial accrued liability		360,856	386,997
3 Payment on 2010 ERI		0	0
4 Total Actuarially Determined Contribution: **(1) + (2) + (3)**		$522,897	$555,090
5 Total Actuarially Determined Contribution, payable on July 1		513,767	545,398

Note: Actuarially Determined Contributions are assumed to be paid on July 1 and December 31, unless otherwise noted.

Section 4: Supplemental Information

Exhibit A: Table of Plan Coverage

Category	Year Ended December 31 2019	2017	Change From Prior Year
Active participants in valuation:			
• Number	9,282	9,168	1.2%
• Average age	47.9	48.1	-0.2
• Average years of service	11.2	11.5	-0.3
• Total payroll[1]	$492,109,775	$451,777,105	8.9%
• Average payroll	53,018	49,278	7.6%
• Member contributions	453,462,416	430,795,611	5.3%
• Number with unknown age	2	9	-77.8%
Inactive participants with a vested right to a deferred or immediate benefit	381	343	11.1%
Inactive participants due a refund of employee contributions	3,082	2,771	11.2%
Retired participants:			
• Number in pay status	4,840	4,532	6.8%
• Average age	73.3	73.4	-0.1
• Average monthly benefit	$2,319	$2,172	6.8%
Disabled participants:			
• Number in pay status	438	433	1.2%
• Average age	67.1	66.8	0.3
• Average monthly benefit	$3,146	$2,911	8.1%
Beneficiaries:			
• Number in pay status	584	566	3.2%
• Average age	75.0	75.3	-0.3
• Average monthly benefit	$1,420	$1,313	8.1%

[1] Payroll figures are for the prior year and reflect annualized salaries for participants hired during the year

Exhibit B: Participants in Active Service as of December 31, 2019 by Age, Years of Service, and Average Payroll

		Years of Service								
Age	**Total**	**0-4**	**5-9**	**10-14**	**15 - 19**	**20 - 24**	**25 - 29**	**30 - 34**	**35 - 39**	**40 & over**
Under 25	369	364	5	- -	- -	- -	- -	- -	- -	- -
	$34,012	$33,799	$49,514	- -	- -	- -	- -	- -	- -	- -
25 - 29	785	689	94	2	- -	- -	- -	- -	- -	- -
	$44,585	$42,890	$57,113	$39,679	- -	- -	- -	- -	- -	- -
30 - 34	782	443	275	63	1	- -	- -	- -	- -	- -
	$54,543	$47,108	$62,695	$71,707	$25,477	- -	- -	- -	- -	- -
35 - 39	756	322	184	174	74	2	- -	- -	- -	- -
	$55,452	$41,058	$62,585	$66,911	$72,289	$96,718	- -	- -	- -	- -
40 - 44	794	335	124	127	155	53	- -	- -	- -	- -
	$54,710	$36,567	$49,327	$67,193	$79,319	$80,101	- -	- -	- -	- -
45 - 49	1,118	369	202	129	174	181	57	6	- -	- -
	$56,904	$35,323	$43,524	$58,847	$75,962	$82,882	$93,452	$109,195	- -	- -
50 - 54	1,503	404	256	213	197	190	137	102	4	- -
	$57,421	$34,668	$45,628	$48,667	$62,832	$76,313	$93,954	$98,714	$108,235	- -
55 - 59	1,505	278	244	253	290	157	81	156	44	2
	$54,910	$37,615	$43,320	$46,242	$49,413	$59,829	$83,086	$96,082	$97,432	$92,445
60 - 64	1,103	144	144	188	243	172	82	76	39	15
	$51,284	$40,155	$46,254	$43,562	$45,816	$52,316	$64,122	$80,147	$82,161	$83,237
65 - 69	409	40	50	43	99	94	50	18	8	7
	$48,716	$30,087	$39,698	$51,450	$46,351	$51,048	$60,499	$52,205	$78,410	$77,866
70 & over	156	11	10	19	29	25	24	21	10	7
	$47,423	$31,717	$51,307	$47,648	$51,132	$41,705	$42,816	$56,476	$48,005	$58,805
Unknown	2	1	- -	- -	- -	- -	- -	- -	1	- -
	$47,667	$22,567	- -	- -	- -	- -	- -	- -	$72,767	- -
Total	9,282	3,400	1,588	1,211	1,262	874	431	379	106	31
	$53,018	$39,132	$50,813	$54,283	$59,270	$66,559	$79,441	$89,524	$85,890	$77,101

Exhibit C: Summary Statement of Income and Expenses on a Market Value Basis

	Year Ended December 31, 2019		Year Ended December 31, 2018	
Net assets at market value at the beginning of the year		$1,350,039,767		$1,378,351,219
Contribution income:				
• Employer contributions	$129,610,441		$120,499,451	
• Employee contributions	49,170,931		46,670,212	
• Federal grant reimbursement and other contributions	75,313		35,762	
• Less administrative expenses	-3,352,400		-3,273,735	
Net contribution income		175,504,285		163,931,690
Investment income:				
• Interest, dividends and other income	$15,437,750		$14,733,931	
• Asset appreciation	200,352,225		-38,644,862	
• Less investment fees	-7,319,763		-7,072,407	
Net investment income		208,470,212		-30,983,338
Total income available for benefits		**$383,974,497**		**$132,948,352**
Less benefit payments:				
• Pensions, annuities, refunds and net transfers	-$161,013,390		-$152,180,341	
• Net 3(8)(c) reimbursements	-7,472,613		-9,079,463	
Net benefit payments		-$168,486,003		-$161,259,804
Change in reserve for future benefits		**$215,488,494**		**-$28,311,452**
Net assets at market value at the end of the year		**$1,565,528,261**		**$1,350,039,767**

Exhibit D: Development of the Fund through December 31, 2019

Year Ended December 31	Employer Contributions	Employee Contributions	Other Contributions	Net Investment Return[1]	Administrative Expenses	Benefit Payments	Market Value of Assets at Year-End	Actuarial Value of Assets at Year-End	Actuarial Value as a Percent of Market Value	Employee Contributions as a Percent of Total Contributions
2010	$76,087,532	$35,031,485	$59,431	$85,309,569	-$3,042,747	-$101,242,424	$781,286,804	$847,368,886	108.5%	31.51%
2011	78,594,607	35,094,482	67,607	1,488,563	-3,075,272	-106,060,828	787,395,962	862,323,395	109.5%	30.85%
2012	81,896,208	35,766,080	37,240	101,170,082	-3,051,893	-116,194,523	887,019,156	875,989,750	98.8%	30.39%
2013	88,252,356	38,568,968	34,756	124,783,005	-3,170,834	-121,473,992	1,014,013,415	967,146,018	95.4%	30.40%
2014	93,368,685	39,806,980	32,261	74,962,895	-3,540,884	-125,082,678	1,093,560,674	1,062,517,426	97.2%	29.88%
2015	99,792,642	40,870,163	27,839	7,817,250	-3,290,167	-134,295,505	1,104,482,897	1,141,122,663	103.3%	29.05%
2016	107,032,211	42,841,461	35,496	74,917,549	-3,460,782	-143,428,636	1,182,420,196	1,229,393,319	104.0%	28.58%
2017	115,377,205	44,841,008	183,914	189,543,974	-3,234,147	-150,780,931	1,378,351,219	1,339,085,622	97.2%	27.96%
2018	120,499,451	46,670,212	35,762	-30,983,338	-3,273,735	-161,259,804	1,350,039,767	1,419,015,659	105.1%	27.91%
2019	129,610,441	49,170,931	75,313	208,470,212	-3,352,400	-168,486,003	1,565,528,261	1,523,736,765	97.3%	27.49%

[1] On a market basis, net of investment fees.

Exhibit E: Table of Amortization Bases

Type	Outstanding Balance as of July 1, 2020	Annual Fiscal 2021 Payment	Outstanding Balance as of July 1, 2021	Annual Fiscal 2022 Payment	Rate of Increase	Years Remaining as of July 1, 2020
2010 ERI	$114,445	$60,290	$59,238	$60,291	0.0%	2.00
Remaining unfunded liability	1,700,605,011	110,021,367	1,708,757,499	117,961,197	N/A	17.00
Total	**$1,700,719,456**	**$110,081,657**	**$1,708,816,737**	**$118,021,488**		

Notes:
Payments assumed to be made on July 1 and December 31.
Payment on remaining unfunded liability reflects adjustment to set fiscal 2021 appropriation to budgeted amount.
Total payment for fiscal 2022 is calculated to increase 6.5% over fiscal 2021.

Exhibit F: Definition of Pension Terms

The following list defines certain technical terms for the convenience of the reader:

Actuarial Accrued Liability for Actives:	The equivalent of the accumulated normal costs allocated to the years before the valuation date.
Actuarial Accrued Liability for Pensioners and Beneficiaries:	Actuarial Present Value of lifetime benefits to existing pensioners and beneficiaries. This sum takes account of life expectancies appropriate to the ages of the annuitants and the interest that the sum is expected to earn before it is entirely paid out in benefits.
Actuarial Cost Method:	A procedure allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability that are used to determine the actuarially determined contribution.
Actuarial Gain or Loss:	A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. To the extent that actual experience differs from that assumed, Actuarial Accrued Liabilities emerge which may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., assets earn more than projected, salary increases are less than assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results yield actuarial liabilities that are larger than projected.
Actuarially Equivalent:	Of equal Actuarial Present Value, determined as of a given date and based on a given set of Actuarial Assumptions.
Actuarial Present Value (APV):	The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. Each such amount or series of amounts is: Adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.) Multiplied by the probability of the occurrence of an event (such as survival, death, disability, withdrawal, etc.) on which the payment is conditioned, and Discounted according to an assumed rate (or rates) of return to reflect the time value of money.
Actuarial Present Value of Future Benefits:	The Actuarial Present Value of benefit amounts expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age, anticipated future compensation, and future service credits. The Actuarial Present Value of Future Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive members entitled to either a refund of member contributions or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would provide sufficient assets to pay all projected benefits and expenses when due.

Section 4: Supplemental Information

Actuarial Valuation:	The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan, as well as Actuariallv Determined Contributions.
Actuarial Value of Assets (AVA):	The value of the Plan's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly plans use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the Actuariallv Determined Contribution.
Actuarially Determined:	Values that have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the Plan.
Actuarially Determined Contribution (ADC):	The employer's periodic required contributions, expressed as a dollar amount or a percentage of covered plan compensation, determined under the Plan's funding policy. The ADC consists of the Employer Normal Cost and the Amortization Payment.
Amortization Method:	A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the Amortization Payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the Unfunded Actuarial Accrued Liability. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.
Amortization Payment:	The portion of the pension plan contribution, or ADC, that is intended to pay off the Unfunded Actuarial Accrued Liability.
Assumptions or Actuarial Assumptions:	The estimates upon which the cost of the Plan is calculated, including: Investment return - the rate of investment yield that the Plan will earn over the long-term future; Mortality rates - the rate or probability of death at a given age for employees and pensioners; Retirement rates - the rate or probability of retirement at a given age or service; Disability rates - the rate or probability of disability retirement at a given age; Withdrawal rates - the rate or probability at which employees of various ages are expected to leave employment for reasons other than death, disability, or retirement; Salary increase rates - the rates of salary increase due to inflation, real wage growth and merit and promotion increases.
Closed Amortization Period:	A specific number of years that is counted down by one each year, and therefore declines to zero with the passage of time. For example, if the amortization period is initially set at 20 years, it is 19 years at the end of one year, 18 years at the end of two years, etc. See Open Amortization Period.
Decrements:	Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or withdrawal.

Section 4: Supplemental Information

Defined Benefit Plan:	A retirement plan in which benefits are defined by a formula based on the member's compensation, age and/or years of service.
Defined Contribution Plan:	A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.
Employer Normal Cost:	The portion of the Normal Cost to be paid by the employer. This is equal to the Normal Cost less expected member contributions.
Experience Study:	A periodic review and analysis of the actual experience of the Plan that may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified based on recommendations from the Actuary.
Funded Ratio:	The ratio of the Valuation/Actuarial Value of Assets (VVA/AVA) to the Actuarial Accrued Liability (AAL). Plans sometimes also calculate a market funded ratio, using the Market Value of Assets (MVA), rather than the VVA/AVA.
GASB 67 and GASB 68:	Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68. These are the governmental accounting standards that set the accounting rules for public retirement systems and the employers that sponsor or contribute to them. Statement No. 68 sets the accounting rules for the employers that sponsor or contribute to public retirement systems, while Statement No. 67 sets the rules for the systems themselves.
Investment Return:	The rate of earnings of the Plan from its investments, including interest, dividends and capital gain and loss adjustments, computed as a percentage of the average value of the fund. For actuarial purposes, the investment return often reflects a smoothing of the capital gains and losses to avoid significant swings in the value of assets from one year to the next.
Net Pension Liability (NPL):	The Net Pension Liability is equal to the Total Pension Liability minus the Plan Fiduciary Net Position.
Normal Cost:	The portion of the Actuarial Present Value of Future Benefits and expenses allocated to a valuation year by the Actuarial Cost Method. Any payment with respect to an Unfunded Actuarial Accrued Liability is not part of the Normal Cost (see Amortization Payment). For pension plan benefits that are provided in part by employee contributions, Normal Cost refers to the total of member contributions and employer Normal Cost unless otherwise specifically stated.
Open Amortization Period:	An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. If the initial period is set as 30 years, the same 30-year period is used in each future year in determining the Amortization Period.
Plan Fiduciary Net Position:	Market value of assets.
Total Pension Liability (TPL):	The actuarial accrued liability under the entry age normal cost method and based on the blended discount rate as described in GASB 67 and 68.

Section 4: Supplemental Information

Unfunded Actuarial Accrued Liability:	The excess of the Actuarial Accrued Liability over the Valuation/Actuarial Value of Assets. This value may be negative, in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus or an Overfunded Actuarial Accrued Liability.
Valuation Date or Actuarial Valuation Date:	The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Benefits is determined. The expected benefits to be paid in the future are discounted to this date.
Valuation Value of Assets	The Actuarial Value of Assets reduced by the value of non-valuation reserves.

Section 5: Actuarial Valuation Basis

Exhibit I: Actuarial Assumptions and Actuarial Cost Method

Net Investment Return:

7.30% (previously, 7.50%).

The net investment return assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment. As part of the analysis, a building block approach was used that reflects inflation expectations and anticipated risk premiums for each of the portfolio's asset classes, as well as the Plan's target asset allocation.

Salary Increases:

Years of Service	Group 1	Group 2	Group 4
0	6.00%	6.00%	7.00%
1	5.50%	5.50%	6.50%
2	5.50%	5.50%	6.00%
3	5.25%	5.25%	5.75%
4	5.25%	5.25%	5.25%
5	4.75%	4.75%	5.25%
6	4.75%	4.75%	4.75%
7	4.50%	4.50%	4.75%
8	4.50%	4.50%	4.50%
9	4.25%	4.25%	4.50%
10	4.25%	4.25%	4.50%
11	4.00%	4.25%	4.50%
12+	4.00%	4.25%	4.50%

Includes an allowance for wage inflation of 3.25%.

The salary scale assumption is a long-term estimate derived from historical data, current and recent market expectations, and professional judgment.

Interest on Employee Contributions:

3.5%

Section 5: Actuarial Valuation Basis

Administrative Expenses:

$3,500,000 for calendar 2020, increasing 3.25% per year (previously, $3,500,000 for calendar 2018, increasing 3.25% per year)

The administrative expense assumption is based on information on expected expenses provided by the Retirement System.

Mortality Rates:

Pre-Retirement: RP-2014 Blue Collar Employee Mortality Table projected generationally with Scale MP-2017

Healthy Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table projected generationally with Scale MP-2017

Disabled Retiree: RP-2014 Blue Collar Healthy Annuitant Mortality Table set forward one year and projected generationally with Scale MP-2017

The mortality tables reasonably reflect the projected mortality experience of the Plan as of the measurement date based on historical and current demographic data. As part of the analysis, a comparison was made between the actual number of retiree deaths and the projected number based on the prior years' assumptions over the most recent ten years. The mortality tables were then adjusted to future years using generational projection under Scale MP-2017 to reflect future mortality improvement.

Termination Rates before Retirement:

	Groups 1 and 2 - Rate (%)		
	Mortality		
Age	Male	Female	Disability
20	0.05	0.02	0.02
25	0.06	0.02	0.02
30	0.06	0.02	0.03
35	0.07	0.03	0.06
40	0.08	0.04	0.10
45	0.13	0.07	0.15
50	0.22	0.12	0.19
55	0.36	0.19	0.24
60	0.61	0.27	0.28

Notes:
Mortality rates do not reflect generational projection.
55% of the disability rates shown represent accidental disability.
20% of the accidental disabilities will die from the same cause as the disability.
55% of the death rates shown represent accidental death.

Section 5: Actuarial Valuation Basis

	Group 4 - Rate (%)		
	Mortality		
Age	Male	Female	Disability
20	0.05	0.02	0.20
25	0.06	0.02	0.20
30	0.06	0.02	0.30
35	0.07	0.03	0.30
40	0.08	0.04	0.30
45	0.13	0.07	1.00
50	0.22	0.12	1.25
55	0.36	0.19	1.20
60	0.61	0.27	0.85

Notes:
Mortality rates do not reflect generational projection.
90% of the disability rates shown represent accidental disability.
60% of the accidental disabilities will die from the same cause as the disability.
90% of the death rates shown represent accidental death.

Section 5: Actuarial Valuation Basis

Withdrawal Rates:

Rate per year (%)			
Years of Service	**Groups 1 and 2**	**Years of Service**	**Group 4**
0	15.0	0 – 10	1.5
1	12.0	11+	0.0
2	10.0		
3	9.0		
4	8.0		
5 – 9	7.6		
10 – 14	5.4		
15 – 19	3.3		
20 – 24	2.0		
25 - 29	1.0		
30+	0.0		

The termination rates and disability rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of terminations and disability retirements and the projected number based on the prior years' assumption over the most recent ten years.

Section 5: Actuarial Valuation Basis

Retirement Rates:

	Rate per year (%)		
	Groups 1 and 2		
Age	Male	Female	Group 4
45 – 49	- -	- -	1.0
50 – 54	- -	- -	2.0
55 – 59	2.0	5.5	15.0
60 – 61	12.0	5.0	20.0
62 – 64	30.0	15.0	25.0
65 – 68	40.0	15.0	100.0
69	50.0	20.0	- -
70	100.0	100.0	- -

The retirement rates were based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment. As part of the analysis, a comparison was made between the actual number of retirements by age and the projected number based on the prior years' assumption over the most recent ten years.

Retirement Rates for Inactive Vested Participants:	Age 60 for Group 1 and Group 2 members and age 55 for participants hired prior to April 2, 2012. For participants hired April 2, 2012 or later, 60 for Group 1, 55 for Group 2 and 50 for Group 4. The retirement age for inactive vested participants was based on historical and current demographic data, adjusted to reflect economic conditions of the area and estimated future experience and professional judgment.
Unknown Data for Participants:	Same as those exhibited by participants with similar known characteristics. If not specified, participants are assumed to be male.
Family Composition:	75% of participants are assumed to be married. None are assumed to have dependent children. Females are assumed to be three years younger than their male spouses.
Benefit Election:	All participants are assumed to elect Option A. The benefit election reflects the fact that all benefit options are actuarially equivalent.
2019 Salary:	2019 salaries are equal to salaries provided in the data, except for actives missing salary and employees with less than one year of service, where salaries are calculated from annualized contributions divided by the contribution rates provided.
Total Service:	Total creditable service reported in the data.
Net 3(8)(c) Liability:	No liability is valued for benefits paid to or received from other municipal systems.

Section 5: Actuarial Valuation Basis

Actuarial Value of Assets:	Market value of assets as reported in the System's Annual Statement less unrecognized return in each of the last five years. Unrecognized return is equal to the difference between the actual market value return and the expected market value return and is recognized over a five-year period, further adjusted, if necessary, to be within 20% of the market value.
Actuarial Cost Method:	Entry Age Normal Actuarial Cost Method. Entry Age is the attained age of the participant less Total Service as defined above. Normal Cost and Actuarial Accrued Liability are calculated on an individual basis and are allocated by salary. Normal Cost is determined using the plan of benefits applicable to each participant.
Justification for Change in Actuarial Assumptions:	Based on past experience and future expectations, the following actuarial assumption was changed as of January 1, 2020: • The investment return assumption was lowered from 7.50% to 7.30%. • The administrative expense assumption was reset from $3,500,000 for calendar 2018, increasing 3.25% per year to $3,500,000 for calendar 2020, increasing 3.25% per year.

Exhibit II: Summary of Plan Provisions

This exhibit summarizes the major provisions of the Plan included in the valuation. It is not intended to be, nor should it be interpreted as, a complete statement of all plan provisions.

Plan Year:	January 1 through December 31
Plan Status:	Ongoing
Retirement Benefits:	Employees covered by the Contributory Retirement Law are classified into one of four groups depending on job classification. Group 1 comprises most positions in state and local government. It is the general category of public employees. Group 4 comprises mainly police and firefighters. Group 2 is for other specified hazardous occupations. (Officers and inspectors of the State Police are classified as Group 3.) For employees hired prior to April 2, 2012, the annual amount of the retirement allowance is based on the member's final three-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following table based on the age of the member at retirement:

Age Last Birthday at Date of Retirement

Percent	Group 1	Group 2	Group 4
2.5	65 or over	60 or over	55 or over
2.4	64	59	54
2.3	63	58	53
2.2	62	57	52
2.1	61	56	51
2.0	60	55	50
1.9	59	--	49
1.8	58	--	48
1.7	57	--	47
1.6	56	--	46
1.5	55	--	45

A member's final three-year average salary is defined as the greater of the highest consecutive three-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last three years of creditable service prior to retirement.

For employees hired on April 2, 2012 or later, the annual amount of the retirement allowance is based on the member's final five-year average salary multiplied by the number of years and full months of creditable service at the time of retirement and multiplied by a percentage according to the following tables based on the age and years of creditable service of the member at retirement:

For members with less than 30 years of creditable service:
Age Last Birthday at Date of Retirement

Percent	Group 1	Group 2	Group 4
2.50	67 or over	62 or over	57 or over
2.35	66	61	56
2.20	65	60	55
2.05	64	59	54
1.90	63	58	53
1.75	62	57	52
1.60	61	56	51
1.45	60	55	50

For members with 30 years of creditable service or greater:
Age Last Birthday at Date of Retirement

Percent	Group 1	Group 2	Group 4
2.500	67 or over	62 or over	57 or over
2.375	66	61	56
2.250	65	60	55
2.125	64	59	54
2.000	63	58	53
1.875	62	57	52
1.750	61	56	51
1.625	60	55	50

A member's final five-year average salary is defined as the greater of the highest consecutive five-year average annual rate of regular compensation and the average annual rate of regular compensation received during the last five years of creditable service prior to retirement.

Section 5: Actuarial Valuation Basis

	For employees who became members after January 1, 2011, regular compensation is limited to 64% of the federal limit found in 26 U.S.C. 401(a)(17). In addition, regular compensation for members who retire after April 2, 2012 will be limited to prohibit "spiking" of a member's salary to increase the retirement benefit. For all employees, the maximum annual amount of the retirement allowance is 80 percent of the member's final average salary. Any member who is a veteran also receives an additional yearly retirement allowance of $15 per year of creditable service, not exceeding $300. The veteran allowance is paid in addition to the 80 percent maximum.
Employee Contributions:	**Date of Hire** / **Contribution Rate** Prior to January 1, 1975 — 5% January 1, 1975 – December 31, 1983 — 7% January 1, 1984 – June 30, 1996 — 8% July 1, 1996 onward — 9% In addition, employees hired after December 31, 1978 contribute an additional 2 percent of salary in excess of $30,000. Employees hired after 1983 who voluntarily withdraw their contributions with less than 10 ten years of credited service receive 3% interest on their contributions. Employees in Group 1 hired on or after April 2, 2012 with 30 years of creditable service or greater will pay a base contribution rate of 6%.
Retirement Benefits (Superannuation):	Members of Group 1, 2 or 4 hired prior to April 2, 2012 may retire upon the attainment of age 55. For retirement at ages below 55, twenty years of creditable service is required. Members hired prior to April 2, 2012 who terminate before age 55 with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System). Members of Group 1 hired April 2, 2012 or later may retire upon the attainment of age 60. Members of Group 2 or 4 hired April 2, 2012 or later may retire upon the attainment of age 55. Members of Group 4 may retire upon attainment of age 50 with ten years of creditable service. Members hired April 2, 2012 or later who terminate before age 55 (60 for members of Group 1) with ten or more years of creditable service are eligible for a retirement allowance upon the attainment of age 55 (60 for members of Group 1) provided they have not withdrawn their accumulated deductions from the Annuity Savings Fund of the System.

Ordinary Disability Benefit:	A member who is unable to perform his or her job due to a non-occupational disability will receive a retirement allowance if he or she has ten or more years of creditable service and has not reached age 55. The annual amount of such allowance shall be determined as if the member retired for superannuation at age 55 (age 60 for Group 1 members hired on or after April 2, 2012), based on the amount of creditable service at the date of disability. For veterans, there is a minimum benefit of 50 percent of the member's most recent year's pay plus an annuity based on his or her own contributions.
Accidental Disability Benefit:	For a job-connected disability, the benefit is 72 percent of the member's most recent annual pay plus an annuity based on his or her own contributions, plus additional amounts for surviving children. Benefits are capped at 75 percent of annual rate of regular compensation for employees who become members after January 1, 1988.
Death Benefits:	In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. Alternatively, if the employee were eligible to retire on the date of death, a spouse's benefit will be paid equal to the amount the employee would have received under Option C. The surviving spouse of a member who dies with two or more years of credited service has the option of a refund of the employee's contributions or a monthly benefit regardless of eligibility to retire, if they were married for at least one year. There is also a minimum widow's pension of $500 per month, and there are additional amounts for surviving children. If an employee's death is job-connected, the spouse will receive 72 percent of the member's most recent annual pay, in addition to a refund of the member's accumulated deductions, plus additional amounts for surviving children. However, in accordance with Section 100 of Chapter 32, the surviving spouse of a police officer, firefighter or corrections officer is killed in the line of duty will be eligible to receive an annual benefit equal to the maximum salary held by the member at the time of death. Upon the death of a job-connected disability retiree who retired prior to November 7, 1996 and could not elect an Option C benefit, a surviving spouse will receive an allowance of $12,000 per year if the member dies for a reason unrelated to cause of disability.
"Heart And Lung Law" And Cancer Presumption:	Any case of hypertension or heart disease resulting in total or partial disability or death to a uniformed fireman, permanent member of a police department, or certain employees of a county correctional facility is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. Any case of disease of the lungs or respiratory tract resulting in total disability or death to a uniformed fireman is presumed to have been suffered in the line of duty, unless the contrary is shown by competent evidence. There is an additional presumption for uniformed firemen that certain types of cancer are job-related if onset occurs while actively employed or within five years of retirement.
Options:	Members may elect to receive a full retirement allowance payable for life under Option A. Under Option B a member may elect to receive a lower monthly allowance in exchange for a guarantee that at the time of death any contributions not expended for annuity payments will be refunded to the beneficiary. Option C allows the member to take a lesser retirement allowance in exchange for providing a survivor with two-thirds of the lesser amount. Option C pensioners will have benefits converted from a reduced to a full retirement if the beneficiary predeceases the retiree.

Section 5: Actuarial Valuation Basis

Post-Retirement Benefits:	The Board has adopted the provisions of Section 51 of Chapter 127 of the Acts of 1999, which provide that the Retirement Board may approve an annual COLA in excess of the Consumer Price Index but not to exceed a 3% COLA on the first $16,000 (previously, $14,000) of a retirement allowance. Cost-of-living increases granted prior to July 1, 1998 are reimbursed by the Commonwealth and not reflected in this report.
Changes in Plan Provisions:	As permitted by Section 19 of Chapter 188 of the Acts of 2010, the Cost of Living Adjustment base was increased from $14,000 to $16,000 as of July 1, 2019.